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VOL. I.

A MONOGRAPH

OF THE

NORTH AMERICAN SPECIES

OF THE

GENUS POLYGONUM.

BY

JOHN KUNKEL SMALL.



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INTRODUCTION.

The genus *Polygonum* is the type of the natural family POLYGONACEAE. This family of dicotyledonous spermatophyta has no very close affinity to other groups, and authors do not differ, to any great degree, as to the relative position of the family.

Among the writers who have arranged groups in a linear sequence, Meisner¹ placed the POLYGONACEAE between PETIVERIACEAE and ERIOGONEAE; Endlicher² brought them in between AMARANTHACEAE and NYCTAGINEAE, Bentham and Hooker³ between the BATIDEAE and the PODOSTOMACEAE. Lately Greene⁴ has placed the family between ILLECEBREAE and NYCTAGINEAE. These different groupings are practically the same and logical as far as the system permits. Baillon,⁵ of all the writers on genera, seems to have made the most illogical disposition of the family in placing it between PLUMBAGINACEAE and JUGLANDACEAE. On the other hand, Engler and Prantl,⁶ working out their system on the divergent lines of the descent of groups, place POLYGONACEAE at the beginning of one of their lines, and follow with the family CHENOPODIACEAE. The limits of the family have with few exceptions been accepted in about the same way. Dumortier,⁷ in 1829, transferred the genus *Eriogonum* to the CHENOPODIACEAE, making it there the type of a tribe. Meisner⁸ some years later removed the genus from that family and raised it to ordinal rank, founding a family on it as a type, and including under it the polygonaceous genera *Pterostegia*, *Mucronea* and *Chorizanthe*.

The family as understood by me embraces some seven hundred species, which fall into about thirty-five natural genera, some of which are monotypic, while others include numerous species. It is distributed throughout the globe, being well represented in the tropical, the temperate and the arctic regions. The greater number of species occur, however, in the Northern Hemisphere. There are a few interesting points concerning the geographical distribution of the genera. In the first place, there are those with a restricted area of distribution and others which are general throughout. We find *Macounia* (*Koenigia* L., not Adans.) confined to a circumboreal zone and to the higher parts of the Himalayas with a corresponding temperature, while such genera as *Coccoloba*, *Symmeria*

¹Pl. Vas. Gen. 228.

²Gen. Pl. 304.

³Gen. Pl. 3 : 88.

⁴Fl. Francis. 132.

⁵Hist. des. Pl. 367.

⁶Nat. Pfl. Fam. 3 : Abt. 1a, 1.

⁷Anal. Fam. 17.

⁸Pl. Vas. Gen. 229.

and *Muhlenbeckia* have their greatest development in the tropics. Besides these two characteristic distributions there are those genera like *Polygonum* and *Rumex* which flourish from the equator to the arctic zones, that is as far as flowering plants can exist.

In the second place, in addition to this general distribution of generic areas, there are conspicuous cases of special limitations. For example, we find *Eriogonum*, one of the larger, and *Nemacaulis* and *Centrostegia*, among the smaller genera, confined for the most part to western North America, *Oxytheca*, *Chorizanthe* and *Pterostegia* to the western portions of North and South America. *Polygonella* and *Thysanella* are mainly in the southeastern United States, while *Pterococcus* and *Calliophysa* are confined to the plains and mountains of eastern Europe and western Asia. Notwithstanding this general and special variation in latitude and altitude and the broad and restricted geographical ranges, the genera all fall into a remarkably well defined family.

The name *Polygonum* is a very ancient derivative, composed of the two Greek words *πολύς* and *γόνυ*, meaning respectively *many* and *knee* or *joint*, alluding to the numerous nodes which are so conspicuous in the stems of many species. It appears to have been associated by the ancient writers with the group to which it was applied by Linnaeus and for which it has since been used.

With *Polygonum aviculare* as a basis, Dr. Pickering¹ gives the following history of the generic name: Heraclides Tarentina, a Greek physician, who lived in the third and second centuries B. C., is said to have prescribed this plant as a remedy against the flowing of blood from the ear. After him other Greek physicians, poets and botanists, such as Nicander, Magnus of Philadelphia and Charixenes seem to have alluded to the plant. The Greek botanist Dioscorides was the first to characterize a form as having "numerous slender branches, creeping on the ground like grass, with fruit at each leaf." Various writers have given the credit of the name to different ancient botanists or pseudo-botanists. For example, Pfeiffer² attributes it to Tournefort, Dietrich³ and Greene⁴ to Columna, and Mueller⁵ to L'Obel. Linnaeus, who elevated botany into a pure science and whose time is the turning point from pseudo-botany to real scientific botany, took up the name *Polygonum* and associated it with the group of plants for which it now stands. At whatever time the historical botanist chooses to start and to whomever he sees fit to refer a genus, the scientific botanist for the sake of avoiding endless confusion and having a sure basis of departure, will not attempt in most instances to seek for names behind the Linnaean period, certainly not beyond that of Tournefort.

The first reference we have to *Polygonum* deals with its real or supposed medicinal

¹ Chron. Hist. Pl. 393.

² Nomencl. Bot. 2 : 795.

³ Syn. Pl. 1319.

⁴ Fl. Francis, 132.

⁵ Syst. Cen. Aust. Pl. 1 : 31.

properties. From that early time to the present, it, like many plants, has been used in the practice of medicine. The genus is of economic interest from three points of view :

First: Some of its members possess medicinal properties to a greater or less extent.¹ The rootstock of *P. Bistorta* and doubtless that of its analogue, *P. bistortoides*, contains much tannin and yields gallic acid. It acts as a powerful astringent. In Europe the roots of *P. amphibium* are often substituted for the true sarsaparilla and in many cases preferred to it. On the other hand, *P. Persicaria*, a species possessing no peculiarly active principles, was during the Middle Ages thought to have the extraordinary power of changing the seat of disease from one part of the body to another. *P. Hydropiper*, whose foliage is remarkably acrid in the fresh state, is a powerful diuretic and acts as a strong vesicant. Other species are also very acrid, as our *P. punctatum*, which has been said to yield a doubtful substance called polygonic acid, which forms in small green deliquescent crystals. Astringent and diuretic properties exist in *P. Virginianum*, but the most interesting plant seems to be the common *P. aviculare*, whose fibrous roots are said to be used as a substitute for quinine in northern and middle Africa, and whose seeds are, according to Lindley, emetic and cathartic. This latter property is so remarkable in the genus that De Candolle thinks the power must lie in the testa and not in the albumen of the seed.

Second: The genus serves as a food plant in some countries. Buckwheat flour, derived from the seeds of *Fagopyrum Fagopyrum*, which has by some authors been included in the genus *Polygonum*, is widely used. The fruit of *P. scandens*, *P. Convolvulus*, *P. cilinode* and others may be substituted for it, although they contain much less nutritive matter. In China the achenes of *Fagopyrum emarginatum* are eaten to a great extent, and the roots of *P. multiflorum* are used in the raw state but become bitter and unpalatable when cooked. On the other hand, in Siberia a fecula is made from the large rootstocks of *P. Bistorta*, and this roasted forms an important food supply in certain districts.

The third point of economic interest regards the dyeing properties of the genus. *P. Hydropiper* imparts a yellow color to wool, and has been used for many years in different parts of Europe. I was informed by the late Mr. Thomas Hogg that in China and Japan a purple dye is made from *P. tinctorium*. This color resembles indigo and is extensively employed. The whole plant of *P. amphibium* is said to be used for tanning in the Western States, and a given quantity will make one-third more leather than a like quantity of oak bark, this species containing eighteen per cent. of tannin opposed to twelve per cent. of the amount present in the best oak bark.²

¹Lindley, Fl. Med. 360-362.

²Coulter, Bot. Bull. 1: 20.

GEOGRAPHIC DISTRIBUTION.

The genus as a whole has a wide distribution, ranging from the tropics to the polar regions, and from the level of the sea to the highest altitudes at which flowering plants can withstand the rigorous environment characteristic of such regions.

The genus divides itself into a number of very natural sections, and we notice a characteristic distribution by subgenera. Thus *Bistorta* is typically arctic, while *Aconogonon* is normally alpine. The subgenus *Tiniaria* is north temperate in its distribution, *Duravia* is Californian, *Tephis* is South African, and *Cephalophilon* is confined to southern Asia. Other sections as *Persicaria*, *Avicularia*, *Amblygonon* and *Echinocaulon* are tropical, temperate and arctic in their range.

There are probably some two hundred and fifty living species; of these about ninety occur in the western and one hundred and sixty in the eastern hemisphere. Seventy are now known to exist in North America, and about thirty species are recorded for South America, and there are forty-two peculiar to the former region, while only fifteen are at the present time known to be endemic in the latter.

THE GENERAL MORPHOLOGY.

During the latter part of this century the genus has been accepted in about the same way that Linnaeus understood it when he wrote the *Species Plantarum*. His contemporaries, however, and the botanists for some years after his time, held quite different views as to its limits. At one time or another the genus as we now understand it has been divided into as many as eight or ten genera. Adanson,¹ for instance, founded a genus *Tephis* on a South African plant. The *Polygonum* of Tournefort was represented by those plants which Meisner² included under his section *Avicularia* and which were embraced by the genus *Centinodia* of J. Bauhin.³ A second genus of Tournefort was *Persicaria*, which is about the same as Adanson's later *Tovara*⁴ and Rafinesque's *Antenoron*.⁵ Loureiro described a genus *Lagunea*,⁶ which is the same as Meisner's section *Amblygonon*, and a third genus of Tournefort was *Bistorta*, which has also fallen to subgeneric rank. *Chylocalyx* of Hasskarl,⁷ now standing as subgenus *Echinocaulon* of Meisner, and the latter's *Tiniaria*, representing Dumortier's *Bilderdykia*,⁸ have stood at one time or another in generic rank.

So *Polygonum* has had a varied history, but of late all these divisions have been brought under one generic head and retained there as sections or subgenera. Although commonly accepted in this way, there has been more or less discussion concerning the

¹ Fam. Pl. 2: 276.

² Monog. 43 and 85.

³ Hist. 3: 374.

⁴ Fam. Pl. 2: 276.

⁵ Fl. Ludov. 28.

⁶ Fl. Coch. 1: 271.

⁷ Beibl. 2: 20.

⁸ Fl. Belg. Prodr. 18.

generic validity of such individuals or groups as *Thysanella*, *Polygonella* and *Fagopyrum*. Linnaeus included the latter two groups under *Polygonum*, the former not being known in his time. In my opinion all three form perfectly good genera. We have excellent characters in the case of *Fagopyrum*. This type resembles *Polygonum* in its habit more than the other two forms in question, but its tissues have a characteristic texture and its leaves a distinctive shape. The most important differences, however, exist in the flower and fruit. The calyx withers, or remains unchanged in fruit, the faces of the achene are pinnately striate and the angles more or less margined or crested, and the embryo is central, the broad cotyledons almost dividing the mealy albumen into halves by an S-shaped curve. None of these characters are possessed by *Polygonum*. In *Polygonella* we find a very strong character in the habit of the species, and they all possess it in about the same degree. Here again the flowers furnish characters to separate this type from *Polygonum*. In the first place, the pedicels are normally solitary, whereas in *Polygonum* they are fascicled, and secondly the calyx either remains unchanged or the three inner segments develop into conspicuous wings in fruit, two characters not belonging to *Polygonum*. *Thysanella* has good characters, but as we are not directly concerned with it, suffice it to say that its affinities are closer to *Polygonella* than to *Polygonum*, and as the former genus is distinct from the latter, if *Thysanella* could not stand generically distinct it would naturally fall into *Polygonella* and not into *Polygonum*.

Polygonum proper therefore consists of herbaceous or shrubby plants, often conspicuous on account of their prominently jointed stems. They are either terrestrial, amphibious or aquatic, and their vegetative organs may be glabrous, glaucous, variously pubescent or glandular. Some species are annual, others are perennial by means of large roots, creeping stems or rootstocks. The roots are variable in size, sometimes slender and fibrous, often large, fusiform and woody. In dry clay soil the development is usually restricted, while in sand they often elongate to a remarkable degree. The subgenus *Bistorta* furnishes two kinds of fleshy rootstocks; the one is bulb-like and the other more or less elongated, either creeping or horizontal. The texture of the tissues of the stems varies from herbaceous to woody, and the habits it has assumed are manifold. Some are erect or prostrate, some float in or on the water, others climb by means of recurved prickles, and still others are scandent by twining stems. They may be strict or flexuous, in most cases unarmed, in a few furnished with strong recurved prickles, and the internodes appear as terete in some cases, in others they are channeled or ridged, while in many species they are gradually or abruptly enlarged towards the nodes, a character so prominent in this genus. The leaves are alternate and follow in a $\frac{2}{3}$ or rarely in a $\frac{1}{2}$ spiral. They vary much, like the other vegetative organs, in their texture and shape, the bases

are rarely auricled, and the blades often glandular-punctate. The blade is either obscurely or conspicuously nerved and rarely three-ribbed, and in one or two instances it has two lateral impressions parallel with the midrib. Very rarely, too, we meet with a keel on the under surface, as in the case of *P. Paronychia*. Towards and in the inflorescence the leaves are sometimes reduced to foliaceous bracts, and all are subtended by stipules in the form of sheaths or ocreae, to which they are articulated or with which they are continuous. The stipules are of unusual form and characteristic. They are united so that they form a sheath which surrounds the stem for a greater or less distance above a node. These ocreae are either cylindric or funnelform; the former usually horizontally truncate at the summit and the latter oblique or two-parted. The summits may be either naked or variously fringed with bristles, and in two subgenera a spreading, collar-like rim is found. The ocreae are either glabrous or strigose, sometimes with smooth or ciliate ribs and rarely with a ring of more or less reflexed hairs around the base.

The inflorescence is both axillary and terminal, appearing as clusters, spikes, racemes or spicate racemes. These different forms may be solitary, geminate, or paniculate and erect or drooping. Ocreae or more or less bract-like ocreolae subtend the flowers, which are borne on usually fascicled, jointed, erect and stout or deflexed and often slender pedicels. The subgenus *Duravia* is the only group in which the flowers are normally solitary at the nodes and in which the inflorescence is what we may call spicate. There are two interesting points suggested here. First, the phenomenon of cleistogamy, and second, fertilization. Little has been written on the former subject. Flowers may be produced on the roots as in the case of *P. punctatum*,¹ or they occur within the ocreae in certain species, as shown by *P. Hydropiper*² and species of other subgenera.³ This latter kind of cleistogamy appears in two different ways. In consequence of the morphology of the plants of this genus, it is liable to occur in any species as illustrated in *P. Hydropiper*. On the other hand, as in the case of members of subgenus *Duravia*, it is the normal condition. Many interesting facts concerning fertilization have been recorded.⁴ Both close and cross-fertilization are common in the genus. The flowers of different species vary in their structure and have adapted themselves as their environment directed. Some have fragrant flowers with eight nectaries, situated at the base of the stamens, which secrete an abundant supply of honey. In other forms these organs, as well as the strength of the fragrance, are less strongly developed, and so the scale descends until in such plants as *P. aviculare*, *P. littorale* and the like, the fragrance, showy calyx and nectaries do not exist. The higher the coloring of the calyx the greater is the development of the

¹ Kearney, Coult. Bot. Gaz. 16 : 314.

³ S. Coulter, Coult. Bot. Gaz. 17 : 91.

² Meehan, Coult. Bot. Gaz 16 : 273 (erroneously published as *P. acre*).

⁴ H. Müller, Fert. of Flowers, 509-516.

nectaries. However, with all this variation and greater or less specialization of organs, there seems to be about as much close as cross-fertilization, and even in the case of species in which cross-fertilization does occur the amount of progeny does not depend upon the cross-fertilization, as has been shown by observation.

The flowers are apetalous, but the calyx is often highly colored and its segments petaloid. It is always persistent, and is usually accrescent after the flowering stage, so that it invests the achene. Glands are often present in its tissues. It is generally five-cleft or five-parted, although we find it in many cases varying from four to six-cleft or parted. The segments are nearly equal or the outer ones larger and often develop keels or conspicuous wings which invest the fruit. From three to nine stamens are present in the flower; five or eight, however, are the prevailing numbers; they are variously inserted on the base of the calyx, sometimes accompanied by a corresponding number of nectaries. The filaments range from filiform to subulate or even bottle-shape; they are persistent and sometimes alternate with small scales, and the oblong or ovoid anthers are attached to these by their backs, the sacs of the latter opening longitudinally. A pistil of variable length surmounts the lenticular or triquetrous ovary, which is one-celled and bears one ovule. The two or three style-segments have usually been considered as so many styles more or less united at the base. In my opinion this is an erroneous way of interpreting the morphology. The ovary is one-celled, bears but one ovule, and finally produces a typical achene. So it is more logical to consider the style as simple and more or less cleft or parted. The cases in which division to the base takes place are comparatively few. We should therefore interpret the state of the style as two or three cleft or parted, as the case may be.

The ovary develops into a lenticular or triquetrous achene. If the style-segments are two the fruit will be lenticular; if three, triquetrous. I have found a state approaching a tetragonous fruit, but have never been able to detect a fourth style-segment.

The achene is either completely invested by the enlarged and persistent calyx or in a few species conspicuously exserted. It has a coriaceous or membranous pericarp, which is smooth and shining or granular and dull. The angles of the fruit are sharp or rounded, and its faces concave or convex. A single seed is developed in each achene. This latter is principally made up of horny or mealy albumen, and usually takes the same shape as the pericarp. The embryo is situated in an angle of the albumen. The cotyledons are slender, foliaceous, accumbent or incumbent. The latter two characters of the embryo vary among the different subgenera, but they are constant in the same subgenus.

THE ANATOMY OF THE STEM OF POLYGONUM.

The genus *Polygonum* is made up of a number of natural groups of plants which are closely related from a morphological standpoint. These groups or subgenera, as they are now technically called, each include a number of species which agree with each other in habit and appearance, and although thus clearly separated from one another, they morphologically form a distinct and natural genus.

Polygonum as represented throughout the world is divided into eleven subgenera. Nine of these occur in America, and eight, namely, *Bistorta*, *Aconogonon*, *Persicaria*, *Tovara*, *Avicularia*, *Duravia*, *Tiniaria* and *Echinocaulon* are indigenous. Although there is more or less variation as regards the separate elements of these sections, the sections as a whole show marked characteristics, especially in habit and habitat.

Bistorta and *Aconogonon* are either alpine or sub-alpine and grow erect. Two other sections, *Persicaria* and *Tovara*, are never normally alpine, they prefer and flourish best in damp situations, their position is usually erect and their aspect not dissimilar. Sections *Avicularia* and *Duravia* thrive best, as a rule, in dry places, while *Tiniaria* is scandent by its twining stems, and *Echinocaulon* reclines on surrounding objects and often climbs by means of recurved prickles.

These general variations in habit and habitat suggested a comparative study of the stems of the eight indigenous sections. For this purpose a type has been selected from each, in most cases the type species, if it is native in America; otherwise a near relative was taken. For *Bistorta*, *Polygonum bistortoides*; for *Aconogonon*, *P. alpinum*; for *Persicaria*, *P. Pennsylvanicum*; for *Tovara*, *P. Virginianum*; for *Avicularia*, *P. aviculare*; for *Duravia*, *P. Californicum*; for *Tiniaria*, *P. scandens*, and for *Echinocaulon*, *P. arifolium*.

The anatomy of the stem of *Polygonum*, as brought out by the eight examples, will be described below, and this general description will be followed by a detailed and comparative account of the structure of each type.

THE GENERAL ANATOMY.

The stems under consideration are composed of three cylinders which are derived from the three cell-layers of the embryonic or meristematic stage. The first, that arising from the *dermatogen layer*, is the epidermis; the second, that following the epidermis and derived from the *periblem layer*, we will designate as the periblematic cylinder, while the third and largest, which is produced by the *plerome*, forms the pleromatic cylinder.

These cylinders, in their mature state, are well developed in all cases, clearly marked off from each other, and are also respectively composed of the same tissues and elements.

However, the cylinders and their elements vary in the degree of development, and the latter in their general and particular arrangement.

Taking up their structure and relation to each other, and beginning at the periphery, we have:

1. THE EPIDERMIS. A cuticle, whose thickness depends on the age and environment of the individual, covers the exposed surface of the epidermal cells in all cases. The epidermis is either simple or double; in the latter case there are two layers of quite similar cells. A slight modification occurs in section *Avicularia*, which will be mentioned under that head.

As a rule, the two usual modifications of epidermal cells are present. These are stomata and trichomes. The former were not plentiful in any of the examples studied, but a greater or less number are developed on the younger parts. As regards the latter, we find both non-glandular and glandular trichomes; the former, however, predominate, and as with the stomata, the trichomes are characteristic of the younger parts of the epidermis, although in a few cases they do exist even on the oldest portions. In some cases the non-glandular trichomes appear as conical unicellular hairs, sometimes depressed, sometimes elongated, but always with a blunt apex. Then there are long bristle-like hairs, also of one cell, but with a long attenuated apex. In other cases we find trichomes similar to the last in all respects save their being multicellular. As a final modification, in two sections we find simple or branched hairs. They are multicellular, and fork either at the base or above it into two or several prongs.

The glandular trichomes consist of black or yellow glands situated at the ends of unicellular hairs.

The epidermis is the first element of the cellular tissues. To anticipate a little, it may be well to mention regions of these tissues as well as the remaining elements. Besides the epidermis, cellular tissue is represented in the primary cortex by the elements of the hypoderma, the large parenchymatous cells of the starch-ring, the accompanying tissue of the sieve-tubes, and finally the most typical and abundant development takes place as pith. The other elements and tissues always present are as follows: Next to the starch-ring there is a greater or less development of sclerenchymatous cells which in most cases form a stereome cylinder; numerous sieve-tubes exist in the phloem regions, and within these is the xylem, made up of its different kinds of tracheae, woody parenchyma and intermediate tissue, all combined into typical collateral bundles.

2. THE PERIBLEMATIC CYLINDER. This zone of the stem contains at least two main tissues in every instance, and in two cases a third one appears. Following the epidermis is the primary cortex consisting of a hypoderma of one or more rows of cells which passes

abruptly or gradually through a layer of somewhat larger parenchymatous cells into the starch-ring. This latter element is always conspicuous, and is usually made up of large oblong or parallelopipedal cells lying in one or several rows. The starch-ring lies against the third cylinder and is generally continuous, being interrupted in some cases, however, by the meeting of the hypoderma and stereome. The periblematic cylinder undergoes no secondary differentiation, but remains in its primary condition throughout, except in subgenera *Avicularia* and *Duravia*, where fascicles of stereid cells occur; in the former they lie next to the epidermis, while in the latter their position is near the starch-ring.

THE PLEROMATIC CYLINDER. In this four main elements are represented, namely, the stereome, the phloem, the xylem and the pith. Next to the starch-ring comes either a strong sheath or fascicles of stereid cells. This tissue in the majority of cases forms a stereome cylinder. Sometimes the walls of these cells are so thick that they almost obliterate the cavities, while in other cases they are comparatively thin. In case no cylinder is found this tissue is represented by fascicles at the outer side of and radially with the collateral bundles.

The phloem occurs mostly as fascicles between the stereome cylinder and the xylem, appearing in cross-section as areas ranging from oblong to almost linear, usually widely separated but rarely nearly continuous but only slightly disconnected between the bundles by the sclerotic or starch-ring elements.

The xylem is developed according to the age and character of the individual. It is composed of tracheae, wood-parenchyma and intermediate tissue, the two latter being most plentiful around the larger elements and at the inner ends of the bundles, where they pass into the pith and in many cases appear as much like cellular tissue as does the pith.

The pith is made up of typical parenchymatous cells, which are polyhedral and either isodiametric or more or less elongated, with the exception of one or two instances in sections *Persicaria* and *Tovara*, in which the cells are broader than high.

PALAEONTOLOGY.

Several species of *Polygona* and polygonaceous plants have been known to occur in the Tertiary strata of the Old World. These have been described from perfect and imperfect leaf specimens and fruits. Some of the species are well marked and characteristic, and can be referred to their respective subgenera, while others described from small fragments of leaves are rather doubtful.

The appended list,¹ embodying all that is at present known to occur in the genus, in the fossil state, has been furnished by Dr. F. H. Knowlton, of the United States National Museum.

While studying a collection of fossil plants with Mr. Hollick last winter, I detected among other new forms a *Polygonum*, remarkably distinct and well preserved. This collection was brought from Florissant, Colorado, a few years ago by Dr. Britton, and deposited in the Geological Museum of Columbia College. Nothing concerning this group has been recorded in North American palaeobotany, but there can be no doubt about the member under consideration. It belongs to the subgenus *Persicaria*, and its nearest living relative is *P. emersum*. The resemblance to that species is striking in the characters of the stem, the way in which the petiole is joined to the ocrea, the leaf, and even in the forking of the secondary nerves of the leaf-blade.

¹ *POLYGONUM ANTIQUM* Heer, Fl. Tert. Helv. **3**: 184, t. 79, f. 27 (1859).

POLYGONUM CARDIOCARPUM Heer, Fl. Tert. Helv. **3**: 184, t. 155, f. 25-27 (1859).

POLYGONUM CONVOLVULOIDES Conwentz, Fl. d. Bernst. **2**: 48, t. 4, f. 23-26 (1886).

POLYGONUM CUSPIDATUM Sieb. & Zucc. (fossil) Nathorst, Foss. Fl. Japans, Pal. Abhandl. **4**: (30) 224, t. 10 (26), f. 16 (1888).

POLYGONUM HYDROPIPER L. ? (fossil) Heer, Urw. d. Schw. 496, 616 (1865).

POLYGONUM OTTERSIANUM Heer, Schweizerischen Naturf. Gesell. in Solothurn, Verhandl. 164 (1869). Fl. Foss. Arct. **2**: pt. 3; t. 11, f. 8^b, 14, 15; t. 12, f. 9-9^b (1870).

POLYGONUM PERSICARIA L. (fossil) Reid, Quart. Journ. Geol. Soc. **48**: 358 (1892).

POLYGONUM ROTUNDATUM Heer, Climat. et Vég. Tert. 45 (1861); Urw. d. Schw. 352, 706 (1865).

POLYGONUM VIVIPARUM L. (fossil) Heer, Urw. d. Schw. 580, 760, t. 12, f. 13 (1865). Schröter, Fl. d. Eiszeit. 26, 35, t. 1, f. 43-44 (1882).

POLYGONUM ? sp. Tasche, Ber. Oberhess. Gesell. Naturkunde, **4**: 94 (1854).

POLYGONITES DEPERDITUS Ett. Beiträge z. Kennt. Tertil. Steiermarks, Sitz. Wien. Akad. **60**: pt. 1, 58, t. 3, f. 15 (1869).

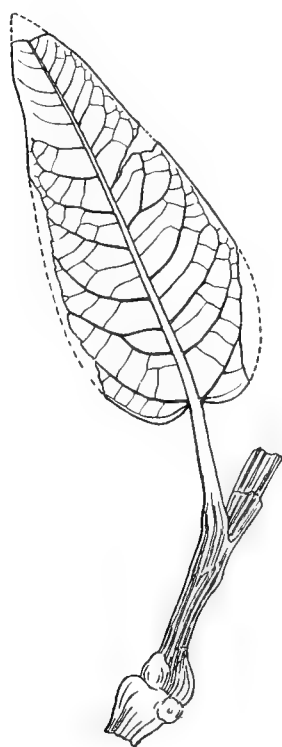
POLYGONITES ULMACEUS Saporta. Ann. Sci. Nat. Bot. (V.) **3**: 92, t. 3, f. 14 (1865).

[PLATE A.]

1. *Polygonum tertiarium*.

Slender. Stem striate and somewhat angled, much enlarged and sparingly gnarled at the nodes, 4 mm. in diameter above the ocrea, 3.5 mm. above the node, and 8-9 mm. at the node; leaf lanceolate, entire, apparently acutish at the apex, sub-cordate at the base, petioled, the lamina 6 cm. long, 2.6 cm. broad, apparently slightly undulate, the midrib about 1.5 mm. broad at the base, the secondary nerves opposite or alternate, leaving the midrib at angles varying from 40 to 45 degrees, soon curving upward, camp-todrome, sometimes coalescing at a point about half way to the margin or forking a short distance from the midrib, joined by tertiary cross-nerves, which leave the secondary one at almost a right angle; petiole 2 cm. long, 1.5 mm. broad at the junction with the lamina, somewhat expanded and 4 mm. broad at the base, joined above the middle of the ocrea; ocrea cylindric, 3 cm. long, irregular at the summit.

In the Miocene Tertiary at Florissant, Colorado.



POLYGONUM TERTIARIUM SMALL.

POLYGONUM Linnaeus.

POLYGONUM Linnaeus, Sp. Pl. 359 (1753). Gmelin, Syst. Nat. 2: 637; Walter, Fl. Car. 131; Willdenow, Sp. Pl. 2: 440; Michaux, Fl. Bor. Am. 1: 237; Persoon, Syn. 1: 439; Muhlenberg, Cat. 40; Pursh, Fl. Am. Sept. 269; Elliott, Bot. S. C. and Ga. 1: 453; Sprengel, Syst. 1: 253; Barton, Comp. Fl. Phila. 1: 186; Torrey, Fl. 400, Comp. 171, Fl. N. Y. 2: 145; Beck, Bot. 300; Meisner, Monog. 1, in Mart. Fl. Bras. 5: 11, in DC. Prodr. 14: 83; Darlington, Florula Cest. 48, Fl. Cest. 247; Eaton & Wright, N. A. Bot. 367; A. Gray, Man. 386; Wood, Cl. Bk. Ed. 41, 473, Am. Bot. and Fl. 282; Chapman, Fl. S. States, 388; Darby, Bot. S. States, 488; S. Watson, Bot. Calif. 2: 10; Behr, Fl. San Fr. 275; Greene, Fl. Francis. 132, Man. Bay. Reg. Bot. 40.

Herbaceous, suffrutescent or suffruticose, glabrous, pubescent, glandular or scurfy, jointed plants, annual or perennial by a woody or fleshy rootstock or by creeping stems, terrestrial, amphibious or aquatic. Stem erect, ascending or prostrate, climbing, twining or floating, fleshy, herbaceous or woody, sometimes emersed or immersed, channeled or ridged, strict or flexuous, more or less enlarged at the nodes. Leaves alternate, entire, membranous, herbaceous, coriaceous or fleshy, rarely keeled, rather distant, mostly arranged in a $\frac{2}{5}$ or $\frac{5}{8}$ spiral, prominently or obscurely nerved, sometimes glaucous, often glandular-punctate, continuous with or articulated to the ocreae, sometimes reduced to foliaceous bracts in and about the inflorescence, with stipules in the form of ocreae. Ocreae cylindric or funnel-form, membranous, hyaline, rarely herbaceous, truncate or oblique at the summit, often two-parted and at length lacerate, naked, ciliate or fringed with bristles, occasionally fringed at the base; inflorescence axillary and terminal, consisting of clusters, racemes, or spicate racemes, either solitary, geminate, or paniculate, or rarely of narrow spikes, in which case the flowers are solitary. Flowers subtended by ocreae or ocreolae; pedicels more or less fascicled, short and stout or long and slender, articulated at the base of the calyx, near the middle or near the base, straight and erect or strongly deflexed. Calyx somewhat herbaceous or membranous, variously colored, persistent, rarely remaining nearly unchanged in fruit, but mostly developing so that it invests the achene, often glandular-punctate, four to six-cleft or four to six-parted, usually five-cleft or five-parted, the segments nearly equal or the outer ones larger, the latter often developing keels or conspicuous wings. Stamens varying from three to nine, usually five or eight, variously disposed on the base of the calyx, the filaments filiform

or subulate, persistent, more or less dilated at the base, and sometimes alternating with small scales; anthers varying from oblong to ovoid, dehiscing longitudinally, attached about the middle of the back. Ovary lenticular or triquetrous; ovule usually stipitate; style two or three-cleft or two or three-parted, sometimes wanting; stigmas two or three, capitate, rarely one, and sessile and more or less two or three-cleft. Achene lenticular or triquetrous, membranous or coriaceous, included in the persistent calyx or more or less exserted, smooth or granular, the angles rounded or sharp, the faces more or less concave or convex. Seed sessile, albuminous, usually of the same shape as the achene, with a broad hilum at the base. Albumen horny or mealy. Embryo situated in one of the angles of the albumen. Cotyledons foliaceous, slender, accumbent or incumbent.

KEY TO THE SUBGENERA.

Alpine or subalpine plants, perennial by a bulb-like, creeping or horizontal rootstock; leaves radical and cauline; ocreae membranous, cylindric, naked, opened obliquely at the summit; inflorescence consisting of a single terminal spicate raceme; flowers subtended by usually toothed bract-like ocreolae; calyx five-parted; stamens varying from five to eight; style three-parted, exserted; achene triquetrous; cotyledons accumbent.

1. BISTORTA.

Alpine or sub-alpine plants, perennial by more or less elongated creeping or horizontal rootstocks; leaves cauline, somewhat fleshy or coriaceous; ocreae funnel-form, membranous, oblique, naked; inflorescence consisting of terminal clusters, racemes or paniculate racemes; flowers subtended by ocreolae; calyx five-parted, stamens eight; style three-cleft; achene triquetrous; cotyledons accumbent.

2. ACONOGONON.

Herbaceous or more or less woody, annual or perennial plants; leaves all cauline; ocreae mostly membranous, cylindric, truncate, naked or variously fringed; inflorescence consisting of terminal, spicate racemes, usually geminate or paniculate; flowers subtended by ocreolae; calyx varying from three-parted to five-parted; stamens varying from four to eight; style two-parted or three-parted, or two-cleft or three-cleft, included or exserted; achene lenticular or triquetrous; cotyledons accumbent.

3. PERSICARIA.

Large annual plants (with the habit of *Persicaria*); leaves cauline; ocreae membranous, cylindric, truncate, with a more or less spreading summit, fringed with bristles; inflorescence consisting of terminal spicate racemes, more or less paniculate; flowers subtended by ocreolae; calyx five-parted; stamens mostly seven, varying from five to eight; style two-cleft; achene lenticular; cotyledons incumbent.

4. AMBLYGONON.

Annual herbaceous plants; leaves cauline, mostly ovate or elliptic-ovate; ocreae membranous, cylindric, fringed with bristles; inflorescence consisting of axillary and terminal much interrupted spicate racemes; flowers subtended by ocreolae; calyx unequally four-parted; stamens five; style two-parted, exserted; achene lenticular, cotyledons accumbent.

5. TOVARA.

Somewhat woody, annual or perennial plants; leaves cauline, often reduced to foliaceous bracts above; ocreae membranous and usually hyaline, funnelform, oblique, two-parted, at length lacerate; inflorescence consisting of axillary clusters, either widely separated or crowded into a terminal raceme; flowers subtended by ocreae; calyx five-parted; stamens mostly eight; style three-parted or wanting and stigma three-cleft; achene triquetrous, included or exserted; cotyledons incumbent.

6. AVICULARIA.

Slender, wiry, brittle annual or perennial plants; leaves narrow and reduced to bracts above, with two lateral nerves; ocreae funnelform, membranous, early conspicuously lacerate or rarely two-parted; inflorescence spicate, the nodes of the shortened branches and branchlets each bearing a single flower; calyx five-cleft or five-parted; stamens eight; style three-parted; achene triquetrous; cotyledons incumbent.

7. DURAVIA.

Annual or perennial, more or less twining plants; leaves usually cordate or truncate; ocreae membranous, funnelform, oblique, naked at the summit, sometimes fringed at the base; inflorescence consisting of loose axillary or terminal clusters, racemes or paniced racemes; flowers subtended by ocreae; calyx five-parted, the outer segments keeled or winged; stamens eight; style three-parted or wanting, the stigma three-cleft; achene triquetrous; cotyledons accumbent.

8. TINIARIA.

Annual or perennial plants, climbing by recurved prickles; leaves mostly hastate or sagittate; ocreae membranous, funnelform, oblique, mostly naked; inflorescence consisting of axillary and terminal racemes or capitate clusters; flowers subtended by ocreolae; calyx five-parted, rarely four-parted; stamens eight; style two-parted or three-parted; achene lenticular or triquetrous; cotyledons accumbent.

9. ECHINOCAULON.

I. SUBGENUS BISTORTA.

Herbaceous alpine or subalpine plants, mostly glabrous, bright green, perennial by a more or less thickened globose or elongated creeping or horizontal rootstock. Rootstock somewhat fleshy, covered with the chaffy remains of modified ocreae. Stem simple, terete or channeled, slender, strict, somewhat fleshy, usually straw-colored. Leaves radical and cauline, the former long-petioled, the latter short-petioled or sessile, flat or more or less revolute, never punctate. Ocreae cylindric, membranous, hyaline, never ciliate, clasping the stem, opened obliquely at the summit. Inflorescence consisting of a single, terminal, spicate raceme. Raceme varying from nearly globose to oblong, densely flowered, sometimes bearing bulblets at the base. Ocreolae bract-like, hyaline, membranous, entire or toothed. Pedicels slender, articulated at the base of the calyx. Calyx five-parted, colored, not glandular-punctate nor much enlarged in fruit. Stamens eight, rarely nine, exserted. Style three-parted, rarely two-parted, exserted. Stigmas minute and inconspicuous. Achene triquetrous, rarely lenticular, brown, smooth or granular, invested by the calyx. Albumen horny. Cotyledons accumbent.

KEY TO THE SPECIES.

- Rootstock elongated; radical leaves acuminate at the base; racemes oblong,
never producing bulblets; achene smooth and shining. 1. *POLYGONUM BISTORTOIDES*.
- Rootstock bulb-like; radical leaves usually cordate or subcordate; racemes
narrowly cylindric, producing bulblets at the base; achene granular
and dull. 2. *POLYGONUM VIVIPARUM*.

2. SUBGENUS ACONOGONON.

Herbaceous and more or less fleshy or suffrutescent plants, glabrous, pubescent or scurfy, sometimes glaucous, perennial by a creeping or horizontal rootstock. Rootstock more or less enlarged, fleshy or woody, chaffy with modified ocreae. Stem mostly erect, becoming woody below, stout or slender, strict or flexuous, simple or branched from the rootstock or throughout. Leaves cauline, fleshy, sometimes becoming coriaceous or thin. Ocreae funnelform, two-cleft, somewhat oblique, membranous, hyaline, thin, brittle, glabrous or pubescent. Inflorescence axillary and terminal, racemose or paniculate, more or less compound, the ultimate divisions ending in racemes. Racemes many-flowered but loose and open, naked or leafy. Ocreolae funnelform, oblique and shallow. Pedicels articulated at the base of the calyx. Calyx colored, five-parted, never glandular-punctate nor much enlarged in fruit. Stamens eight, included. Style three-parted, more or less exserted. Stigmas capitate. Achene triquetrous, brownish or greenish, nearly smooth, at length protruding slightly beyond the calyx. Albumen horny. Cotyledons accumbent.

KEY TO THE SPECIES.

- Inflorescence consisting of axillary and terminal racemes or panicled racemes.
Leaves lanceolate; panicles compound and dense; achene obovoid. 3. *P. ALPINUM*.
Leaves ovate; panicles nearly simple; achene ovoid. 4. *P. PHYTOLACCAEFOLIUM*.
- Inflorescence consisting of axillary clusters and racemes.
Leaves more or less petioled, usually pubescent or scurfy; achene obovoid. 5. *P. NEWBERRYI*.
Leaves sessile, nearly glabrous, glaucous; achene ovoid. 6. *P. DAVISIAE*.

3. SUBGENUS PERSICARIA.

Herbaceous or suffrutescent, terrestrial or aquatic, annual or perennial plants, becoming more or less woody at the base or throughout, glabrous, pubescent or glandular. Stems erect or prostrate and creeping, sometimes floating, simple or variously branched, more or less channeled, never twining nor climbing. Leaves cauline, entire or somewhat

eroded, glabrous or pubescent, mostly ciliate, petioled or sessile, often glandular-punctate. Ocreae cylindric, becoming funnelform at branching nodes, mostly membranous, truncate, naked, ciliate or fringed with bristles, ribbed, striate, often brittle. Inflorescence terminal, geminate or paniculate, more or less compound or rarely simple, the ultimate divisions ending in spicate racemes. Racemes varying from linear to ovoid, dense and erect, or few-flowered, lax and drooping. Ocreolae funnelform, naked, ciliate or fringed with short bristles. Pedicels rather stout, articulated at the base of the calyx. Calyx more or less colored, varying from white and green to red, often glandular-punctate, five-cleft or five-parted, investing the achene by enlargement after flowering. Stamens varying from four to eight, included or exserted. Style mostly two-cleft or two-parted, sometimes three-cleft or three-parted on the same plant, included or exserted, stigmas capitate. Achene mostly lenticular, sometimes triquetrous and lenticular on the same plant, usually black, smooth or granular, its faces concave or convex, its edges rounded or sharp. Albumen horny. Cotyledons accumbent.

KEY TO THE SPECIES.

Racemes usually solitary (sometimes two); plants more or less aquatic.

Ocreae neither spreading at summit nor fringed.

Leaves elliptic, oblong or elliptic-lanceolate, obtuse.

7. *P. AMPHIBIUM*.

Leaves ovate-lanceolate or oblong-lanceolate, acuminate.

9. *P. EMERSUM*.

Ocreae spreading at summit and mostly fringed.

8. *P. HARTWRIGHTII*.

Racemes numerous (at least several), more or less paniculate or geminate; plants normally terrestrial.

Ocreae cylindric, naked (occasionally ciliate when young).

Racemes erect; achenes only lenticular.

Achene strongly biconvex; style longer than the achene, parted to below the middle.

10. *P. PORTORICENSE*.

Achene strongly biconvex; style shorter than the achene, parted to near the base.

11. *P. FERRUGINEUM*.

Achene flat, ovoid, gibbous on one side, thick-pointed; style short.

17. *P. MEXICANUM*.

Achene flat, ovoid, gibbous on both sides, slender-pointed; style exserted.

18. *P. LONGISTYLUM*.

Achene flat, orbicular, not gibbous; style mostly included.

19. *P. PENNSYLVANICUM*.

Racemes erect; achenes both lenticular and triquetrous.

16. *P. PRINGLEI*.

Racemes drooping; achenes mostly lenticular, sometimes triquetrous.

Achene broadly oblong-ovoid; flowers flesh-colored; style two-parted to below the middle.

14. *P. LAPATHIFOLIUM*.

Achene ovoid; flowers whitish, green or rose-colored; style two-parted to near the base.

15. *P. INCARNATUM*.

Ocreae cylindric, fringed with bristles.

Racemes erect, not interrupted; achenes lenticular.

Ocreae spreading; stem more or less hispid.

12. *P. HISPIDUM*.

Ocreae not spreading; stem mostly glabrous.

Achene obovoid, biconvex.

13. *P. ACUMINATUM*.

Achene ovoid, plano-concave; leaves ciliate.

23. *P. SEGETUM*.

Achene ovoid-oblong, flat; leaves eciliate.

22. *P. FUSIFORME*.

Racemes erect, not interrupted; achenes lenticular or triquetrous.

Ocreae conspicuously fringed; achene broadly ovoid.

20. *P. PERSICARIA*.

Ocreae inconspicuously fringed; achene narrowly ovoid.

21. *P. PERSICARIOIDES*.

Racemes erect, not interrupted; achenes triquetrous.

Stem mostly glabrous; leaves more or less petioled.

Ocreolae conspicuously fringed.

26. *P. OPELOUSANUM*.

Ocreolae inconspicuously fringed.

Leaves mostly glabrous above; achene pointed at the apex.

27. *P. HYDROPIPEROIDES*.

Leaves mostly strigose above; achene pointed at both ends.

25. *P. SETACEUM*.

Stem more or less densely hispid with reddish hairs; leaves sessile or nearly so.

28. *P. HIRSUTUM*.

Racemes drooping, not interrupted; achenes lenticular.

24. *P. CAREYI*.

Racemes drooping, interrupted; achenes lenticular or triquetrous.

Leaves ovate or ovate-lanceolate; achene granular and dull.

29. *P. HYDROPIPER*.

Leaves lanceolate or linear-lanceolate; achene smooth and shining.

30. *P. MINUS*.

Racemes erect, interrupted; achenes lenticular or triquetrous.

31. *P. PUNCTATUM*.

4. SUBGENUS AMBLYGONON.

Herbaceous or suffrutescent plants, stout, annual or perennial (with the general characters of subgenus *Persicaria*). Stem mostly erect, terete, becoming woody below, branched above. Leaves large, pubescent or glabrous, entire, petioled. Ocreae cylindric, conspicuous by the spreading summit, strigose and fringed. Inflorescence terminal and axillary, paniculate, the ultimate divisions ending in spicate racemes. Racemes linear or oblong, rather dense, more or less drooping. Ocreolae funnelform, oblique, ciliate. Pedicels articulated at the base of the calyx. Calyx colored, showy, five-cleft, investing the achene by developing after flowering. Stamens mostly seven, rarely in fives, sixes or eights, included. Style two-cleft, included, the stigmas capitate, large, dark-colored, conspicuous. Achene lenticular, biconcave, smooth and shining, the edges rounded. Albumen horny. Cotyledons incumbent.

One species.

32. *P. ORIENTALE*.

5. SUBGENUS TOVARA.

Annual herbaceous plants becoming somewhat woody below. Stem mostly erect, virgate, simple or virgately branched, somewhat channeled. Leaves membranous, short-petioled, acute at both ends. Ocreae cylindric, fringed with bristles. Inflorescence axillary and terminal, consisting of spicate racemes. Racemes linear, very long and wand-like, conspicuously interrupted. Calyx more or less colored, somewhat recurved, four-parted, the segments unequal. Stamens five, included. Style two-parted, conspicuously exserted, the segments recurved or curled. Achene lenticular, strongly biconvex, brown or cream-colored, smooth and shining. Albumen horny. Cotyledons accumbent.

One species.

33. *P. VIRGINIANUM*.

6. SUBGENUS AVICULARIA.

Herbaceous, suffrutescent or suffruticose plants, annual or perennial by a woody rootstock, glabrous, more or less scurfy, often glaucescent or glaucous. Stem erect, ascending or prostrate, virgate, slender or stout, more or less ridged, simple or variously branched, either from the base or above or throughout. Leaves cauline only, rather coriaceous or somewhat fleshy, variously nerved, flat or revolute, sometimes with two lateral impressions parallel with and on either side of the midrib, more or less conspicuously articulated to the ocreae, often reduced to bracts towards the ends of the branches. Ocreae funnelform, more or less oblique, two-parted when young, at length lacerate, hyaline, never fringed, more or less nerved. Inflorescence axillary, consisting of clusters bearing normally several flowers at each node throughout the plant or confined to the branches and branchlets, forming thus terminal, either interrupted or continuous spicate racemes. Calyx five-parted, rarely six-parted, mostly green with white, pink or rose-colored margins, occasionally colored. Stamens varying from three to eight, often five or six, included. Style three-cleft or three-parted, included or exserted at maturity, sometimes almost wanting and the stigma nearly sessile. Achene triquetrous, included or slightly exserted, brown or black, granular or smooth and shining. Albumen horny. Cotyledons incumbent.

KEY TO THE SPECIES.

Perennial by large, woody, creeping rootstocks.

Inflorescence crowded at the ends of branches; ocreae conspicuously lacerate; achene black.

34. *P. PARONYCHIA*.

Inflorescence not crowded at the ends of the branches; ocreae inconspicuous, lacerate; achene chestnut-colored.

35. *P. SHASTENSE*.

Annual or perennial, but not by rootstocks.

Plants prostrate ; achenes exerted.

Leaves shorter than the internodes.

36. *P. RAYI*.

Leaves longer than the internodes.

37. *P. MARITIMUM*.

Plants prostrate ; achenes included.

Achene pointed at the apex, rounded at the base.

Leaves mostly obtuse ; style three-parted to the base.

38. *P. LITTORALE*.

Leaves mostly acute ; style three-parted to below the middle.

39. *P. AVICULARE*.

Achene pointed at both ends.

Slender and wiry ; leaves narrow ; plants not arctic.

40. *P. BELLARDI*.

Short and stout ; leaves broad ; plants arctic.

41. *P. BOREALE*.

Plants erect ; achenes conspicuously exerted.

43. *P. EXSERTUM*.

Plants erect ; achenes included, never conspicuously exerted.

Flowers in axillary clusters.

Branched throughout ; branches more or less spreading ; large plants.

Achene broadly ovoid ; style three-parted to below the middle.

42. *P. ERECTUM*.

Achene broadly ovoid ; style three-parted to the base ; leaves mostly fugacious.

45. *P. CAMPORUM*.

Achene ovoid ; style very short, three-parted to the base ; leaves not fugacious.

44. *P. RAMOSISSIMUM*.

Branched mainly from the base ; branches erect or ascending ; small plants.

Pedicels erect.

Leaves oblanceolate, sometimes much reduced above ; achene narrowly oblong ; style nearly wanting.

47. *P. SAWATCHENSE*.

Leaves obovate, not much reduced above ; achene oblong ; style three-parted.

51. *P. MINIMUM*.

Leaves linear or linear-lanceolate ; achene ovoid.

48. *P. TENUE*.

Pedicels deflexed.

Achene oblong.

46. *P. DOUGLASII*.

Achene ovoid, not constricted at the ends.

49. *P. ENGELMANNI*.

Achene ovoid ; constricted at both ends.

50. *P. AUSTINAE*.

Flowers in mostly interrupted spicate racemes at the ends of branches.

Achene oblong ; filaments not conspicuously dilated ; style three-parted to the middle.

52. *P. SPERGULARIAEFORME*.

Achene ovoid ; filaments conspicuously dilated ; style three-parted to base.

53. *P. NUTTALLII*.

Flowers mostly in continuous terminal spicate racemes.

Racemes bracted.

Outer calyx segments longer than the inner ; bracts winged.

55. *P. POLYGALOIDES*.

Outer calyx segments not longer than the inner ; bracts not winged.

56. *P. WATSONI*.

Racemes leafy ; leaves hardly imbricated.

54. *P. KELLOGGII*.

7. SUBGENUS DURAVIA.

Suffrutescent or suffruticose, very slender and glabrous plants, annual or perennial by a woody rootstock. Stem generally erect, rarely decumbent with erect branches, wiry, more or less branched, strict or flexuous, usually clothed with a dark brown or reddish, shining bark. Leaves narrow and inconspicuous, somewhat coriaceous or fleshy, reduced to bracts towards the ends of the branches and branchlets, not articulated to the ocreae, with two more or less prominent ribs, developed along the margins. Ocreae funnelform, soon much lacerate as a rule, the segments bristle-like, rigid, soft or cottony, contiguous and imbricated on the branches and branchlets, more or less distant on the stems. Calyx sessile, rather colored, five-parted, mostly hidden in the ocreae. Stamens usually eight, included. Style three-parted, appearing as the summit of the ovary or achene split into three segments, the segments more or less divergent. Achene triquetrous, chestnut-colored or brown, smooth and shining or granular and dull. Albumen horny. Cotyledons incumbent.

KEY TO THE SPECIES.

Plant perennial, with a branched base.

57. *P. BOLANDERI*.

Plants annual, with simple bases.

Ocreae conspicuously lacerate, mostly distant, the segments rather weak.

58. *P. CALIFORNICUM*.

Ocreae conspicuously lacerate, mostly imbricated, the segments very rigid.

59. *P. GREENEI*.

Ocreae conspicuously lacerate, the segments cottony.

60. *P. PARRYI*.

Ocreae two-parted, the segments ovate, sharply toothed.

61. *P. BIDWELLIAE*.

8. SUBGENUS TINIARIA.

Herbaceous or suffruticose plants, glabrous, pubescent or more or less scurfy, annual or perennial, unarmed. Stem erect and woody or extensively twining and soft, more or less channeled. Leaves membranous or coriaceous, cordate, hastate or sometimes sagittate, petioled or sessile. Ocreae funnelform, oblique, naked or fringed at the summit or base. Inflorescence axillary or terminal, racemose or paniculate, more or less compound, the ultimate divisions being racemes. Racemes loosely flowered, leafy, leafy-bracted or naked. Calyx membranous, green, white or yellowish, five-parted, the three outer segments naked, keeled or strongly and conspicuously winged, borne on slender, reflexed and articulated pedicels. Stamens eight, included. Style three-parted, short or almost wanting, the three-cleft stigma nearly sessile. Achene triquetrous, dark brown or black, included, smooth and shining or granular and dull. Albumen horny. Cotyledons accumbent.

KEY TO THE SPECIES.

Outer segments of calyx unchanged or developing keels in fruit.

Inflorescence consisting mostly of axillary and terminal clusters and simple racemes; achene granular.

62. *P. CONVOLVULUS*.

Inflorescence consisting mostly of axillary and terminal panicled racemes; achene smooth.

63. *P. CILINODE*.

Outer segments of calyx developing conspicuous wings.

Inflorescence consisting of axillary and terminal simple racemes.

Racemes leafy; fruiting calyx 1 cm. long; wings crisped.

64. *P. SCANDENS*.

Racemes leafy-bracted; fruiting calyx .5 cm. long; wings nearly flat.

65. *P. DUMETORUM*.

Racemes naked; fruiting calyx .5 cm. long; wings incised.

66. *P. CRISTATUM*.

Inflorescence consisting of axillary and terminal panicled racemes.

67. *P. ZUCCARINII*.

9. SUBGENUS ECHINOCAULON.

Herbaceous plants, glabrous but usually armed, annual or sometimes perennial. Stem ascending and reclining, four-angled, more or less channeled, armed on the angles with recurved prickles, by means of which it climbs over objects. Leaves truncate, hastate or cordate, membranous, petioled or sessile, the petiole, midrib and principal nerves armed with small recurved prickles. Ocreae funnelform, very oblique, finely nerved, variously roughened about the base. Inflorescence terminal and axillary, more or less paniculate or dichotomous, the ultimate divisions ending in spicate racemes, usually somewhat interrupted or capitate clusters. Calyx somewhat colored, four-parted or five-parted. Stamens varying from five to eight, mostly in fives, sixes or eights, included. Style two-cleft or three-cleft, mostly two-parted or three-parted, included. Achene lenticular or triquetrous, variously colored, strongly biconvex or sharply angled, smooth and shining. Albumen horny. Cotyledons accumbent.

KEY TO THE SPECIES.

Leaves sagittate or subsagittate; achene triquetrous.

Inflorescence dichotomous; leaves subsagittate, nearly sessile.

68. *P. MEISNERIANUM*.

Inflorescence simple or paniculate; leaves sagittate, more or less petioled.

69. *P. SAGITTATUM*.

Leaves hastate; achene lenticular.

70. *P. ARIFOLIUM*.



[PLATE 1.]

I. *Polygonum bistortoides* Pursh.

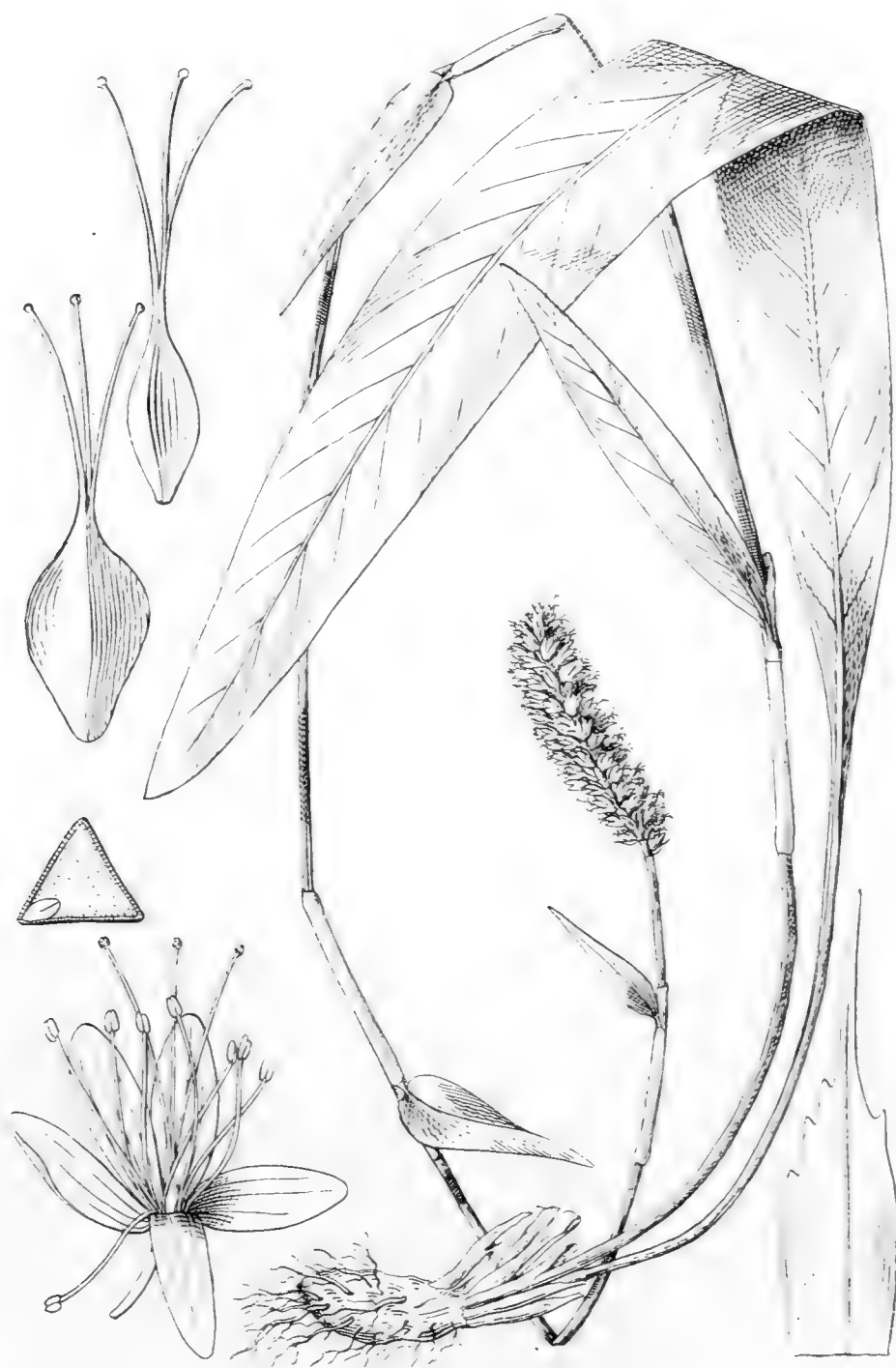
Polygonum Bistorta Chamisso & Schlechtendal, *Linnaea*, **3**: 37 (1828), not Linnaeus; Hooker, *Fl. Bor. Am.* **2**: 130; Meisner in *DC. Prodr.* **14**: 125; S. Watson, *Bot. King's Exp.* 317, *Bot. Calif.* **2**: 14; Porter & Coulter, *Syn. Fl. Col.* 123; Coulter, *Man. Bot. Rocky Mt. Reg.* 320; Greene, *Fl. Francis.* 137.

Polygonum bistortoides Pursh, *Fl. Am. Sept.* 271 (1814); Meisner, *Monog.* 51; Eaton & Wright, *N. A. Bot. Ed.* 8, 367.

Polygonum Bistorta var. *oblongifolium* Meisner in *DC. Prodr.* **14**: 126 (1856); Porter & Coulter, *Syn. Fl. Col.* 124.

Perennial, glabrous or sometimes with a fine hispidulous pubescence on the under surface of the leaves, more or less glaucous throughout. Rootstock enlarged, fleshy, creeping or horizontal, chaffy with the remains of modified ocreae; stem erect or assurgent, 2.5–7 dm. long, slender, simple; radical leaves oblong-lanceolate, oblong or oblanceolate, 10–25 cm. long, .5–3 cm. broad, acute or obtusish, acuminate at the base; the mid-rib rather broad and conspicuous on both sides; petioles 5–20 cm. long; cauline leaves mostly narrowly lanceolate, 3–15 cm. long, sessile (except some of the lower ones), subcordate or cordate, arising from near the summit of the ocreae, all often revolute and conspicuously nerved; ocreae narrowly cylindric, 4–8 cm. long, entire or somewhat broken about the more or less expanded obliquely opened summit, clasping the stem closely, sometimes split from the attachment of the leaf to the base; inflorescence consisting of a single terminal spicate raceme; raceme oblong, 1–6 cm. long, 1–1.5 cm. broad, densely flowered; ocreolae lanceolate or oblong, 3–6 mm. long, acuminate, toothed, strongly one-ribbed; pedicels slender, 3–7 mm. long, articulated at the base of the calyx; calyx about 4 mm. long, colored, varying from light rose color to white, five-parted nearly to the base, the segments oblong, faintly nerved; stamens eight, exserted; style three-parted nearly to the base, 3–4 mm. long, exserted; achene triquetrous, 3.5–4 mm. long, rhombic obovoid, narrowed at the base, light brown, smooth and shining.

Alpine and subalpine parts of the mountains of Colorado, Arizona and California, northward to the arctic regions.



POLYGONUM BISTORTOIDES PURSH.

***Polygonum bistortoides linearifolium* (S. Watson) Small.**

Polygonum Bistorta var. *linearifolium* S. Watson, Bot. King's Exp. 317 (1871).

Polygonum bistortoides var. *linearifolium* Small, Bull. Torr. Club, **19**: 352 (1892).

More slender than the typical form; stem erect, 2-4 dm. tall; radical leaves lanceolate, 3-4 cm. long, acute; cauline leaves few (three to five), 2-6 cm. long, linear-lanceolate or narrowly linear, revolute, sparingly hispidulous beneath; raceme ovoid, less than 2 cm. long.

Alpine and subalpine parts of the mountains of Colorado and Nevada.

[PLATE 2.]

2. *Polygonum viviparum* Linnaeus.

Polygonum viviparum Linnaeus, Sp. Pl. 360 (1753); Gmelin, Syst. Nat. 2: 639; Persoon, Syn. 1: 439; Pursh, Fl. Am. Sept. 271; Eaton, Man. 371; Torrey, Fl. 1: 401, Comp. 171; Meisner, Monog. 52, in DC. Prodr. 14: 124; Chamisso & Schlechtendal, Linnaea, 3: 38; Beck, Bot. 301; Hooker, Fl. Bor. Am. 2: 30; Eaton & Wright, N. A. Bot. Ed. 8, 367; A. Gray, Man. 368; Wood, Cl. Bk. Ed. 41, 475, Am. Bot. and Fl. 283; S. Watson, Bot. Calif. 2: 15; Coulter, Man. Bot. Rocky Mt. Reg. 321.

Polygonum viviparum var. *subacaule* Pursh, Fl. Am. Sept. 271 (1814).

Perennial, more or less glaucescent throughout, glabrous, except some occasional hispidulous pubescence on the lower surface of the leaves. Rootstock generally bulb-like, chaffy; stems solitary or sometimes several together, erect, .2-3 dm. high, simple, somewhat channeled above; radical leaves oblong or lanceolate, 2-10 cm. long, 1-2.5 cm. broad, acute or acutish, cordate, subcordate or sometimes acuminate and rather unsymmetrical at the base; petioles slender, 3-10 cm. long; cauline leaves narrowly lanceolate or linear, 2-8 cm. long, the lower more or less petioled, the upper sessile, all often revolute and apparently crenulate by the enlarged and prominent nerves; mid-rib broad and conspicuous on the lower surface of the leaves; ocreae narrowly cylindric, 1-6 cm. long, clasping the stem below, gradually expanding towards the obliquely opened summit, entire, but more or less broken at the brittle top; inflorescence consisting of a single terminal spicate raceme; raceme narrowly-cylindric, 2-10 cm. long, .5-1 cm. broad, rather densely flowered above, bearing a number of bulblets about the base; bulblets ovoid-conic, 3-5 mm. long, dark brown; ocreolae obovate, 2-3 mm. long, entire or dentate at summit, thin, acuminate or cuspidate by the excurrent rib; pedicels 1-2 mm. long; calyx about 3 mm. long, colored, pale rose color or white, five-parted to near the base, the segments three-nerved, ovate or obovate, undulate; stamens eight, exserted; style about 3 mm. long, deeply three-parted, exserted; achene triquetrous, 1-1.5 mm. long, oblong, dark-brown, granular and dull.

Alpine summits of the White Mountains, in the Lake Superior Region, northward to Greenland and Iceland and in the alpine parts of the mountains of Colorado, through Utah and Nevada, to Southern Oregon and northward. Also in Europe and Asia.



POLYGONUM VIVIPARUM LINNAEUS.

[PLATE 3.]

3. *Polygonum alpinum* Allioni.

Polygonum alpinum Allioni, Fl. Pedem. **2**: 206. *t. 68. f. 1* (1785); Persoon, Syn. **1**: 440; Meisner, Monog. 56; Hooker, Fl. Bor. Am. **2**: 131.

Polygonum polymorphum Ledebour, Fl. Ross. **3**: 524 (1849); Meisner in DC. Prodr. **14**: 139; Greene, Fl. Francis, 137.

Polygonum polymorphum var. *alpinum* Ledebour, Fl. Ross. **3**: 524 (1849); Meisner in DC. Prodr. **14**: 139; S. Watson, Bot. King's Exp. 317; Bot. Calif. **2**: 15.

Perennial, stout, glabrous or slightly pubescent throughout, bright green. Stem erect, 9–20 dm. long, channeled, more or less branched; leaves lanceolate, 3–18 cm. long, 1–4 cm. broad, acute or acuminate at the apex, mostly acuminate at the base, coriaceous, slightly crisped, short-petioled; ocreae funnelform, 1–3 cm. long, oblique and two-cleft, the segments acute, mostly glabrous, large and loose, brittle and early falling away; inflorescence paniculate, the divisions consisting of compound racemes or paniculate racemes; racemes loosely flowered, 1–4 cm. long; ocreolae funnelform, about 1 mm. long, oblique and shallow; pedicels slender, 3 mm. long; calyx greenish or whitish, 3 mm. long, five-parted to near the base, the segments obovate or oblong, rounded; stamens five to eight, included; style about .5 mm. long, three-parted to near the base, included; achene triquetrous, 4 mm. long, broadly ovoid or oblong, acute, protruding beyond the calyx, light chestnut colored or brownish, smooth and shining.

Subalpine and alpine parts of the mountains of Nevada, California, Oregon and Idaho. Also in Europe and Asia.

***Polygonum alpinum foliosum* (Keller) Small.**

Polygonum polymorphum var. *foliosum* Keller, Bull. Soc. Bot. Belg. **30**: 49 (1891).

Polygonum alpinum var. *foliosum* Small, Bull. Torr. Club, **19**: 360 (1892).

Stout, pubescent throughout. Stem sparingly branched, hispid; leaves ovate-lanceolate, acute, petioled, more or less tomentose beneath, ciliate, numerous near the ends of the branches; ocreae funnelform, large, loose, hispid; flowers fewer; achene broadly oblong, greenish.

High mountains of Washington, about 6,000–7,000 feet altitude.



POLYGONUM ALPINUM ALLIONI.

Polygonum alpinum Alaskanum Small.

Polygonum alpinum var. *lapathifolium* Chamisso & Schlechtendal, *Linnaea*, **3**: 38 (1828), not *P. lapathifolium* Linnaeus.

Polygonum polymorphum var. *lapathifolium* Ledebour, *Fl. Ross.* **3**: 254 (1849).

Stout, arising from a large rootstock. Stem erect, 5-9 dm. long, fleshy above; leaves ovate-lanceolate, 8-22 cm. long, 1-8 cm. broad, acuminate, obtuse or cordate at the base, thin, pubescent on both surfaces or sometimes glabrous, ciliate, undulate, much crisped; petioles 1-4 cm. long; ocreae funnelform, 2-4 cm. long, thin, striate, more or less hispid.

Alaska and southward on the high mountains to Washington.

[PLATE 4.]

4. *Polygonum phytolaccaefolium* Meisner.

Polygonum phytolaccaefolium Meisner; Small, Bull. Torr. Club, **19**: 360 (1892).

Perennial, glabrous or very sparingly pubescent with slender inconspicuous hairs, light green, turning dark in drying. Stem erect, 4–8 dm. long, somewhat branched, channeled, slightly flexuous; internodes much shorter than the leaves; leaves ovate or ovate-lanceolate, 3–14 cm. long, 1–6 cm. broad, acute or acuminate at the apex, often ciliate, obtuse or acute at the base, thin, undulate and somewhat crisped, sometimes coriaceous; ocreae funnelform, 1–2 cm. long, brittle, early falling away, more or less pubescent; inflorescence rather simple, consisting of axillary and terminal racemes or panicled racemes; racemes few, loosely-flowered, 2–6 cm. long, more or less interrupted; ocreolae similar to the ocreae but smaller; pedicels slender, 2 mm. long, articulated above the middle; calyx whitish or pinkish, nearly 2 mm. long, not much enlarged in fruit, five-parted to below the middle, the segments obovate, two often much smaller than the rest; stamens eight, included; style less than .5 mm. long, three-parted to the base; achene triquetrous, nearly 4 mm. long, ovoid, somewhat pointed at both ends, exceeding the calyx, light brown, smooth and shining or slightly granular.

Mountains of Washington, Oregon and California.



POLYGONUM PHYTOLACCAEFOLIUM MEISNER.



[PLATE 5.]

5. *Polygonum Newberryi* Small.

Polygonum Newberryi Small, Bull. Torr. Club, **21**: 170 (1894).

Perennial, dull green, fleshy and stout, more or less puberulent and scurfy throughout or sometimes glabrous. Stem erect, or nearly so, 1–4 dm. long, stout, slightly channeled, more or less flexuous, nearly simple or short-branched above, the upper internodes one-third as long as the lower ones; leaves ovate or broadly oblong-ovate, 1–4.5 cm. long, .5–3 cm. broad, the upper subsessile, the lower short-petioled, obtuse or subapiculate at the apex, truncate, obtuse or acute at the base, becoming more or less rugose-wrinkled with age and in drying, attached near the base of the ocreae; ocreae funnelform, .5–1.5 mm. long, light brown, puberulent or nearly glabrous, thin and brittle; inflorescence axillary, consisting of racemes or spicate racemes; racemes narrow, 1–2 cm. long, few-flowered, sometimes interrupted; ocreolae funnelform, 1 mm. long, acutish; pedicels, 1 mm. long; calyx greenish, 3 mm. long, five-parted to near the base, the segments oblong or oblong-elliptic, the outer ones larger than the inner; stamens eight, included; style 1 mm. long, three-parted, included; achene triquetrous, 4–4.5 mm. long, obovoid, sometimes unsymmetrical, light brown, smooth and shining, somewhat exerted at maturity.

Alpine and subalpine regions in the mountains of Oregon and Washington.



POLYGONUM NEWBERRYI SMALL.



[PLATE 6.]

6. *Polygonum Davisiae* Brewer.

Polygonum Davisiae Brewer; A. Gray, Proc. Am. Acad. 8: 399 (1872); S. Watson, Bot. Calif. 2: 15; Greene, Fl. Francis. 138.

Perennial from an enlarged and woody rootstock, glabrous and glaucous or inconspicuously pubescent. Stems usually several from the enlarged base, erect or ascending, .5–4 dm. long, striate, flexuous, sparingly branched above or sometimes simple, leafy throughout; leaves varying from ovate to oblong, sometimes almost lanceolate, 1–8 cm. long, .5–3.5 cm. broad, obtuse or acutish, sessile or subsessile, varying from subcordate to acuminate at the base, undulate and ciliate, sometimes unsymmetrical; ocreae funnel-form, .5–1 cm. long, more or less oblique; inflorescence consisting of terminal and axillary clusters; clusters loose, two to four-flowered; ocreolae funnelform, 1 mm. or less long; pedicels slender, 2–3 mm. long; calyx purplish green or yellowish, 2.5 mm. long, five-cleft to the middle, much narrowed toward the base; stamens eight, included; style about .5 mm. long, three-parted to the base; achene triquetrous, about 3 mm. long, oblong-ovoid, protruding beyond the persistent calyx, light brown, smooth and shining.

On the highest slopes of the mountains from Washington to the Sierras of central California.



POLYGONUM DAVISIAE BREWER.



[PLATE 7.]

7. *Polygonum amphibium* Linnaeus.

Polygonum amphibium Linnaeus, Sp. Pl. 361 (1753); Gmelin, Syst. Nat. 2: 637; Willdenow, Sp. Pl. 2: 443; Michaux, Fl. Bor. Am. 1: 240; Persoon, Syn. 1: 440; Sprengel, Syst. 2: 259; Meisner, Monog. 67, in DC. Prodr. 14: 115; Torrey, Fl. 1: 403, Comp. 172; Beck, Bot. 301; Hooker, Fl. Bor. Am. 2: 131; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 388; Wood, Cl. Bk. Ed. 41, 475, Am. Bot. & Fl. 283; S. Watson, Bot. Calif. 2: 13; Coulter, Man. Bot. Rocky Mt. Reg. 320; Greene, Fl. Francis. 137, Man. Bay Reg. Bot. 42.

Polygonum amphibium var. *natans* Michaux, Fl. Bor. Am. 1: 240 (1803); Meisner, Monog. 67, in DC. Prodr. 14: 115.

Polygonum coccineum Muhlenberg, Cat. 40 (1813); Willdenow, Enum. Hort. Berol. 1: 429 (1809); Pursh, Fl. Am. Sept. 271; Eaton, Man. 371; Barton, Comp. Fl. Phila. 188; Sprengel, Syst. 2: 259; Eaton & Wright, N. A. Bot. Ed. 8, 368; Wood, Cl. Bk. Ed. 41, 475.

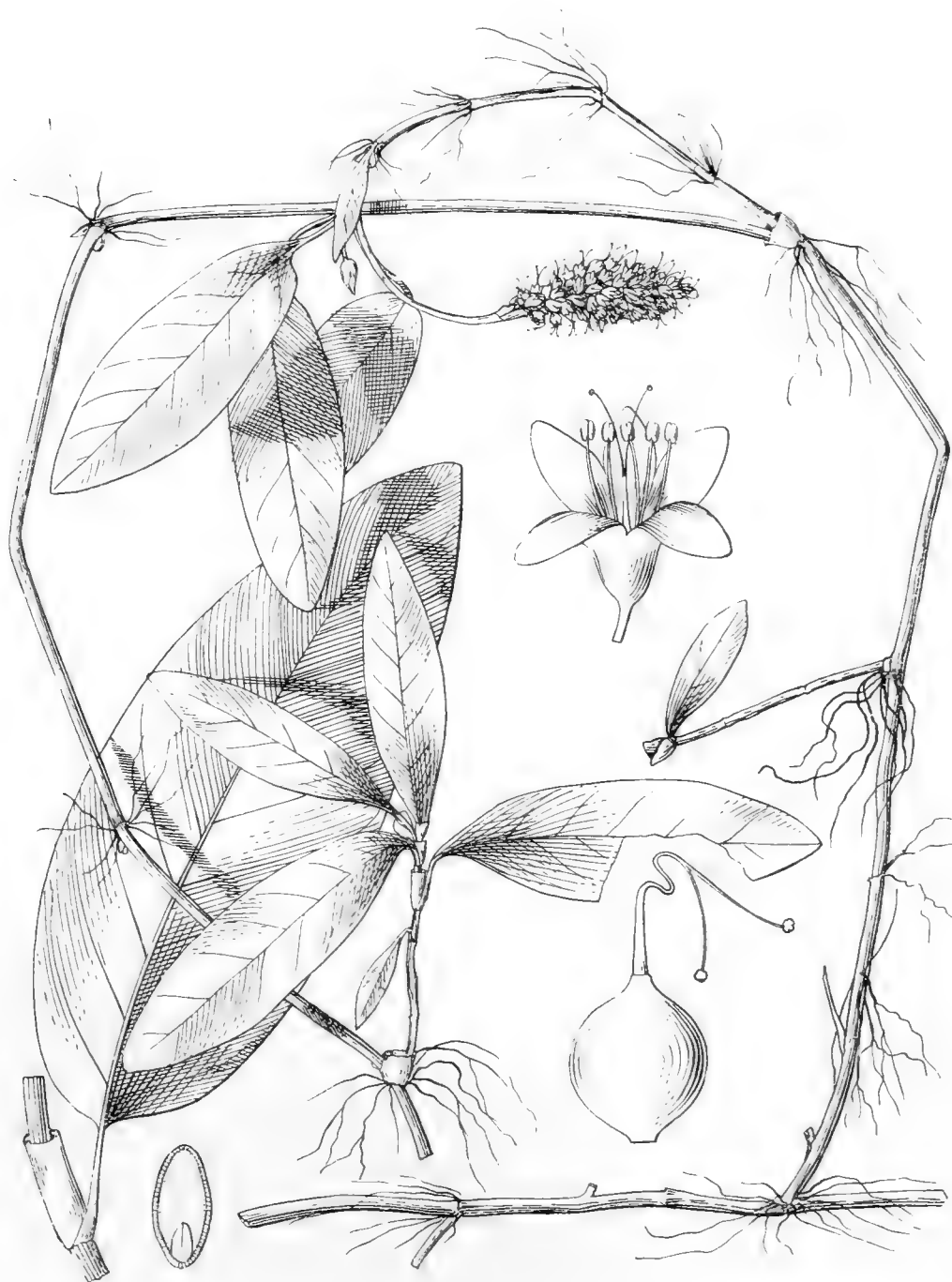
Polygonum coccineum var. *aquaticum* Pursh, Fl. Am. Sept. 271 (1814).

Polygonum fluitans Eaton, Man. 274 (1817); Eaton & Wright, N. A. Bot. Ed. 8, 368.

Polygonum amphibium var. *aquaticum* Torrey, Fl. 1: 404 (1824), Comp. 172; Beck, Bot. 301; A. Gray, Man. 388.

Polygonum amphibium var. *fluitans* Wood, Cl. Bk. Ed. 41, 475 (1855).

Perennial, glabrous when mature, young shoots often pubescent. Stem immersed or floating on the surface of the water and rooting in the mud, 6–60 dm. long, branches usually arising from the rooting nodes; leaves oblong, elliptic or elliptic-lanceolate, 3–11 cm. long, 5–5 cm. broad, thickish and somewhat coriaceous, glossy above, obtuse or subacute at the apex, slightly unsymmetrical, rounded or narrowed at the base, ciliate or eciliate; petioles almost wanting or sometimes 6 cm. long; ocreae cylindric, those of the stem 1.5–2.5 cm. long, those of the branches exceeding the internodes, truncate or rarely with a spreading rim at the summit, nearly eciliate or fringed with a few bristles; inflorescence consisting of a single terminal spicate raceme; raceme oblong, ovoid or conic, 1–3 cm. long, erect, very dense; ocreolae funnel-form, 2–3 mm. long, membranous, very thin; pedicel 1.5–2 mm. long; calyx light rose-colored, 4.5 mm. long, five-parted to below the



POLYGONUM AMPHIBIUM LINNAEUS.

middle; stamens five, exserted; style 3.5 mm. long, two-cleft to above the middle, exserted; achene lenticular, 2.5 mm. long, orbicular-oblong or obovoid, conspicuously biconvex, black, smooth, shining, or somewhat granular and rather dull.

Quebec to British Columbia, south to New Jersey, Minnesota, Colorado and southern California. Also in Europe and Asia.

[PLATE 8.]

8. *Polygonum Hartwrightii* A. Gray.

Polygonum Hartwrightii A. Gray, Proc. Am. Acad. 8: 294 (1870); S. Watson, Bot. Calif. 2: 14; Coulter, Man. Bot. Rocky Mt. Reg. 320; Greene, Fl. Francis. 136, Man. Bay Reg. Bot. 42.

Perennial, more or less hispid throughout, except when growing in the water. Stem creeping and ascending or suberect, 3–7 dm. long, leafy, channeled, glabrous or hispid; leaves narrowly lanceolate, oblong-lanceolate or oblong, 6–18 cm. long, 1.5–3 cm. broad, obtuse or acutish at both ends, short-petioled or sessile; ocreae cylindric, 1–1.5 cm. long, almost half as long as or equalling the internodes, with a more or less patent rim at the summit fringed with short bristles; inflorescence consisting normally of a single terminal spicate raceme; raceme varying from oblong to conic, 1–3 cm. long, erect; ocreolae funnelform, 1–2 mm. long, somewhat oblique, ciliate, membranous, very thin; pedicels about 2 mm. long; calyx rose-colored, 3–4.5 cm. long, five-parted to below the middle; stamens five, exserted; style 3–4 mm. long, two-parted to below the middle, exserted; achene lenticular, 2.5 mm. long, oblong or broadly oblong, conspicuously biconvex, black, smooth and shining, or minutely granular and dull.

Quebec and the Hudson Bay region west to the Pacific Ocean, south to New Jersey, southern Pennsylvania, Kansas and Lower California.



POLYGONUM HARTWRIGHTII A. GRAY.

[PLATE 9].

9. *Polygonum emersum* (Michaux) Britton.

Polygonum amphibium var. *emersum* Michaux, Fl. Bor. Am. 1: 240 (1803).

Polygonum coccineum var. *terrestre* Pursh, Fl. Am. Sept. 271 (1814); Beck, Bot. 301.

Polygonum amphibium var. *terrestre* Torrey, Fl. 1: 403 (1824), not Willdenow; Torrey, Comp. 172; Meisner, Monog. 67; Darlington, Fl. Cest. 250; A. Gray, Man. 388; Wood, Am. Bot. and Fl. 283.

Polygonum amphibium var. *Muhlenbergii* Meisner in DC. Prodr. 14: 116 (1856).

Polygonum Muhlenbergii S. Watson, Proc. Am. Acad. 14: 245 (1879); Bot. Calif. 2: 13; Coulter, Man. Bot. Rocky Mt. Reg. 320; Behr, Fl. San Francisco, 276; Greene, Fl. Francis. 137, Man. Bay Reg. Bot. 42.

Polygonum terrestre Britton, Sterns & Poggenberg, Prel. Cat. N. Y. 46 (1888).

Polygonum emersum Britton, Trans. N. Y. Acad. Sci. 8: 73 (1889).

Perennial, glabrous or strigose throughout. Stem more or less creeping in wet places, the distal end erect, 3–8 dm. long, mostly simple, leafy, enlarged at the nodes, channeled, lower parts becoming hollow; leaves broadly-lanceolate or oblong-lanceolate, sometimes narrowly-lanceolate, 5–20 cm. long, 1–6 cm. broad, acute or acuminate at the apex, rounded, cordate, narrowed or truncate at the base, lateral nerves prominent and often forking; ocreae cylindric, 2–3 cm. long, the younger clasping the stem, the older ones loose and inflated near the base, eciliate; inflorescence consisting of one or two terminal spicate racemes; racemes linear-oblong or linear, 3–10 cm. long, erect, dense; ocreolae funnelform, oblique, 2 mm. long, fringed with short bristles; pedicels slender, 1–2 mm. long; calyx dark rose-colored, sometimes pink, 4 mm. long, five-parted to the middle; stamens five, exserted; style 2.5 mm. long, two-cleft to above the middle, exserted; achene lenticular, 3 mm. long, broadly-obovoid or orbicular, conspicuously biconvex, black, slightly granular but shining.

Throughout North America from the Arctic regions to the City of Mexico.



POLYGONUM EMERSUM (MICHAX) BRITTON.

[PLATE 10.]

10. Polygonum Portoricense Bertero.

Polygonum acuminatum Meisner, Monog. 78 (1826), not Humboldt, Bonpland and Kunth.

Polygonum glabrum Chamisso & Schlechtendal, Linnæa, 3: 46 (1828), not Willdenow; Meisner, Monog. 78, and in DC. Prodr. 14: 114; Grisebach, Fl. Br. W. Ind. 161.

Polygonum densiflorum Meisner in Mart. Fl. Bras. 5: 13 (1855), not Blume; Meisner in DC. Prodr. 14: 121; Chapman, Fl. S. States, 388.

Polygonum Portoricense Bertero; Meisn. in DC. Prodr. 14: 121 (1856), as synonym.

Polygonum densiflorum var. *imberbe* Meisner in DC. Prodr. 14: 121 (1856).

Polygonum Pennsylvanicum var. *densiflorum* Wood, Am. Bot. and Fl. 283 (1873).

Perennial, glabrous but more or less scurfy throughout. Stem erect, 8–13 dm. long, branched, enlarged at the nodes, often of a dark brown color; leaves lanceolate or narrowly-lanceolate, 3–25 cm. long, 1–4 cm. broad, acuminate at both ends, very obscurely punctate, short-petioled; midrib broad and lateral nerves prominent or conspicuous beneath; petiole 1–2 cm. long; ocreae cylindric, 2–4 cm. long, fringed with short bristles when young, at length eciliate, sometimes hispid; inflorescence paniculate, more or less compound, the ultimate divisions ending in spicate often geminate racemes; racemes linear, 2–11 cm. long, erect, dense; ocreolae funnelform, about 3 mm. long, oblique, narrow, obtuse or acute, with a membranous rim; pedicels 3–3.5 mm. long; calyx white or whitish, about 3 mm. long, five-parted to near the base; stamens six, sometimes eight, included; style 1.5 mm. long, two-parted or three-parted to below the middle, somewhat exserted; achene lenticular or triquetrous, 2.5 mm. long, very broadly oblong or nearly obicular, sometimes slightly obovoid and broader than high, strongly biconvex, black, smooth and shining or sometimes minutely granular.

Southern Missouri to Texas and Florida, also in the West Indies and South America, except the extreme south.



POLYGONUM PORTORICENSE BERTERO.

[PLATE 11.]

II. *Polygonum ferrugineum* Weddell.

Polygonum ferrugineum Weddell, Ann. Sci. Nat. (III.) **13**: 252 (1849).

Polygonum spectabile Martius; Meisner in Mart. Fl. Bras. **5**: 13. *t. 3* (1855) and in DC. Prodr. **14**: 119.

Polygonum gummiiferum Weddell, Ann. Sci. Nat. (III.) **13**: 252 (1849)?

Perennial, nearly glabrous but more or less scurfy. Stem erect, 6–9 dm. long, glabrous, somewhat fleshy below, simple or sparingly branched above, internodes short; leaves lanceolate, 5–17 cm. long, 1–3.3 cm. broad, acuminate at both ends, bearing a few short hairs on the petiole and midrib; petiole 1–2 cm. long; ocreae cylindric, 2–4 cm. long, sparingly fringed when young, at length eciliate, the older ones more or less inflated, imbricated on the stem; inflorescence paniculate, nearly simple, the ultimate divisions ending in spicate racemes; racemes linear, 2–4 cm. long, erect, densely-flowered; ocreolae funnelform, 3 mm. long, acutish and serrate at the summit; pedicels at length 2–3 mm. long; calyx pink, 3–4 mm. long, rather strongly nerved; stamens six or seven, included; style 1–1.5 mm. long, two-parted to near the base, somewhat exserted; achene lenticular, 3–3.5 mm. long, orbicular, strongly biconvex, its faces often slightly biconcave near the apex, nearly black, smooth and shining.

The West Indies and eastern Brazil.



POLYGONUM FERRUGINEUM WEDDELL.

[PLATE 12.]

12. *Polygonum hispidum* Humboldt, Bonpland & Kunth.

Polygonum hispidum Humboldt, Bonpland & Kunth, Nov. Gen. **2**: 178 (1817); Sprengel, Syst. **2**: 259; Meisner, Monog. 80, in Mart. Fl. Bras. **5**: 12. *t.* 2 and in DC. Prodr. **14**: 122.

Perennial, stout and leafy, more or less glutinous. Stem erect or spreading, 3–10 dm. long, simple or sparingly branched, hispid and glandular; leaves varying from ovate to broadly lanceolate, 8–22 cm. long, 2–8 cm. broad, acuminate, glandular, base conspicuously decurrent on the petiole, glabrous or hispidulous on and about the midrib and nerves; petiole .5–1.5 cm. long, hispid or glandular; ocreae cylindric, 1–3 cm. long, large, base more or less contiguous, expanded into a patent rim at the summit, very hispid, fringed with spreading bristles; inflorescence paniculate, rather simple, the ultimate divisions ending in spicate racemes; racemes linear-oblong, 2–10 cm. long, erect, continuous, densely flowered, reddish; ocreolae funnelform, 3 mm. long, oblique, spreading at the summit, fringed with short bristles; pedicels about 3 mm. long; calyx white or rose-purple, 4.5 mm. long, five-parted to below the middle; stamens five; style 3 mm. long, two-parted to below the middle, exserted; achene lenticular, 4.5 mm. long, orbicular-obovoid or orbicular-oblong, sometimes abruptly pointed and broader than high, slightly biconcave, black, smooth and shining.

The West Indies, Central America and northern and eastern South America as far south as Paraguay.



POLYGONUM HISPIDUM HUMBOLDT, BONPLAND AND KUNTH.

[PLATE 13.]

13. *Polygonum acuminatum* Humboldt, Bonpland and Kunth.

Polygonum acuminatum Humboldt, Bonpland & Kunth, Nov. Gen. **2**: 178 (1817); Sprengel, Syst. **2**: 256; Meisner, Monog. 78, Mart. Fl. Bras. **5**: 14. *t. 4* and in DC. Prodr. **14**: 114; Grisebach, Fl. Br. W. Ind. 161.

Polygonum cuspidatum Willdenow; Sprengel, Syst. **2**: 256 (1825).

Polygonum erectum Vellozo, Fl. Flum. **4**: *t. 42* (1827)?

Polygonum acuminatum var. *Humboldtii* Meisner in Mart. Fl. Bras. **5**: 14. *t. 4. f. 1* (1855).

Perennial, stout, more or less strigose except the stem, leafy. Stem erect or ascending, 6 dm. long, glabrous below, strigose about the inflorescence, dark brown, somewhat enlarged at the nodes, sometimes covered with the ocreae; leaves lanceolate or oblong-lanceolate, 6–30 cm. long, 1–4 cm. broad, acute or acuminate at both ends, usually nearly sessile, strigose on both surfaces or rarely nearly glabrous, the midrib and lateral nerves prominent beneath; ocreae cylindric, 2–4 cm. long, strigose, somewhat loose at the summit, fringed with long stout more or less hispid bristles; inflorescence paniculate or nearly simple, the ultimate divisions ending in spicate sometimes geminate racemes; racemes dense, 4–10 cm. long; ocreolae bract-like, sometimes imbricated, 3 mm. long, conspicuously fringed, sparingly pubescent; pedicels 3–4 mm. long; calyx white, 3 mm. long, four or five-parted to near the base, the segments oblong or ovate, obtuse, not punctate; stamens five to nine, mostly six, included; style two-parted, exserted; achene lenticular, obovoid or oblong, 2–2.5 mm. long, thick-pointed, black, smooth and shining, the faces strongly biconvex.

The West Indies, Central and South America. Also in the Galapagos.



POLYGONUM ACUMINATUM HUMBOLDT, BONPLAND AND KUNTH.



[PLATE 14.]

14. *Polygonum lapathifolium* Linnaeus.

Polygonum lapathifolium Linnaeus, Sp. Pl. 360 (1753); Aiton, Hort. Kew, 2: 30; Gmelin, Syst. Nat. 2: 637; Persoon, Syn. 1: 439; Muhlenberg, Cat. 40; Eaton, Man. 370; Sprengel, Syst. 2: 257; Torrey, Fl. 1: 404, Comp. 172; Meisner in Mart. Fl. Bras. 5: 16, in DC. Prodr. 14: 119; Beck, Bot. 302; Eaton & Wright, N. A. Bot. Ed. 8, 367; A. Gray, Man. 387; Gay, Fl. Chil. 5: 267; Wood, Cl. Bk. Ed. 41, 474.

Polygonum Pennsylvanicum Curtis, Fl. Lond. t. 73 (1777), not Linnaeus.

Polygonum Persicaria var. *lapathifolium* Meisner, Monog. 69 (1826).

Polygonum incarnatum Wood, Cl. Bk. Ed. 41, 474 (1855).

Annual, stout, glabrous or more or less pubescent throughout. Stem mostly erect, 3–6 dm. long, branched above or throughout, sometimes nearly simple, thickened at the nodes; peduncles and pedicels more or less glandular; leaves varying from broadly lanceolate to narrowly lanceolate, sometimes oblong-lanceolate, 5–20 cm. long, .5–5 cm. broad, attenuate towards the apex from the broadest part, acuminate at the base, ciliate, inconspicuously but thickly punctate, short-petioled; petiole and midrib slightly hispid, the latter and lateral nerves prominent beneath; ocreae cylindric, 1–2 cm. long, loose, striate or ribbed, thin, brittle, slightly ciliate when young, at length eciliate; inflorescence paniculate, more or less compound, the ultimate divisions ending in spicate racemes; racemes linear-oblong or almost linear, 2–8 cm. long, mostly drooping, dense; ocreolae funnelform, 2 mm. long, very oblique, acute; pedicels 2–3 mm. long; calyx flesh-colored or whitish, 2–2.5 mm. long, five-parted to below the middle; stamens six, included; style 1–1.5 mm. long, two-parted or three-parted to below the middle, included; achenes lenticular or rarely triquetrous, 2–2.5 mm. long, very broadly oblong or broadly ovoid, biconcave, brownish or black, slightly granular but usually shining.

Throughout North America except the extreme north, Mexico, Central America and the West Indies. Apparently introduced from Europe.

***Polygonum lapathifolium incanum* (Schmidt) Koch.**

Polygonum incanum Schmidt, Fl. Boem. 4: 90 (1795).

Polygonum Persicaria var. *incanum* Meisner, Monog. 68 (1826).



POLYGONUM LAPATHIFOLIUM LINNAEUS.

Polygonum lapathifolium var. *incanum* Koch, Syn. Fl. Germ. 711 (1837); Coulter, Man. Bot. Rocky Mt. Reg. 319; A. Gray, Man. Ed. 6, 440 (1890).

Small and slender. Stem erect, .5–3 dm. long, simple or branched, slightly scurfy; leaves lanceolate, ovate or oblong, acute or obtuse, often attenuate at the bases, glabrous above, clothed with white tomentum beneath, short-petioled or sessile; racemes oblong, 1–3 cm. long, erect; achene lenticular, 2.5 mm. long, ovoid, slightly biconcave, dark brown, rather smooth and shining.

Nova Scotia to Central New York westward to the Pacific, and in the Rocky Mountains. Also in Europe.

***Polygonum lapathifolium nodosum* (Persoon) Small.**

Polygonum nodosum Persoon, Syn. 1: 440 (1805); Meisner in Mart. Fl. Bras. 5: 16, and in DC. Prodr. 14: 118; Porter, Bot. Wheeler Ex. 232; S. Watson, Bot. Calif. 2: 13; Coulter, Man. Bot. Rocky Mt. Reg. 320; Behr, Fl. San Francisco, 276; Greene, Fl. Francis. 136, Man. Bay Reg. Bot. 41.

Polygonum utriculatum Remy in Gay, Fl. Chil. 5: 267 (1849).

Polygonum lapathifolium nodosum Small, Mem. Torr. Club, 5: 140 (1894).

Generally robust and glabrous. Stem erect, 3–8 dm. long, stout, red or reddish, marked with purple spots and dark rings below the ocreae, usually much thickened at the nodes; leaves lanceolate or narrowly lanceolate, short-petioled or sessile; ocreae cylindric, 1.5–2 cm. long, loose, strongly ribbed; racemes oblong-cylindric, 2–6 cm. long, erect, dense; style two-parted to below the middle; achene lenticular, 2 mm. long, broadly oblong or ovoid, black, shining but slightly granular.

Range about the same as the type. Also in Chili.

[PLATE 15.]

15. *Polygonum incarnatum* Elliott.

Polygonum incarnatum Elliott, Bot. S. C. & Ga. 1: 456 (1817); Sprengel, Syst. 2: 258; Meisner, in DC. Prodr. 14: 120; Darby, Bot. S. States, 489; Chapman, Fl. S. States, 388; Wood, Am. Bot. and Fl. 283; Coulter, Man. Bot. Rocky Mt. Reg. 319.

Polygonum lapathifolium Beck, Bot. 302 (1833); Wood, Cl. Bk. Ed. 41, 474 (1855).

Polygonum nodosum var. *incarnatum* A. Gray, Man. Ed. 2, 372 (1856).

Polygonum lapathifolium var. *incarnatum* S. Watson in A. Gray, Man. Ed. 6, 440 (1890).

Annual, nearly glabrous throughout, light green. Stem erect, 6–10 dm. long, almost simple or branched, especially above, more or less thickened at the nodes; leaves lanceolate or narrowly-lanceolate, 5–20 cm. long, .4–4 cm. broad, acuminate at both ends, sparingly punctate and ciliate, short-petioled the midrib bearing a few short, thick hairs; ocreae cylindric or funnelform at branching nodes, 1–2 cm. long, loose, brittle, eciliate or occasionally ciliolate when young; inflorescence paniculate, more or less compound, the ultimate divisions ending in spicate racemes; racemes linear, 3–8 cm. long, drooping, dense; ocreolae funnelform, 2 mm. long, oblique, cuspidate; pedicels 2 mm. long; calyx whitish, green or rose-colored, 2–3 mm. long, five-parted to near the base; stamens six, included; style less than 1 mm. long, two-parted to near the base; achene lenticular, 2 mm. long, ovoid or broadly oblong-ovoid, flat and biconcave, dark brown or black, smooth and shining.

Southern New England to Minnesota, south to Florida and Texas.



POLYGONUM INCARNATUM ELLIOTT.



[PLATE 16].

16. *Polygonum Pringlei* Small.

Polygonum Pringlei Small, Bull. Torr. Club, **19**: 357 (1892).

Perennial, slender, glandular, light green. Stem erect or decumbent and creeping, 6–15 dm. long, branched, glandular throughout, the base becoming woody; leaves varying from linear-lanceolate to linear, 3–10 cm. long, .2–.8 cm. broad, acuminate at both ends, ciliate, obscurely punctate, subsessile; ocreae cylindric or becoming funnelform when old, .5–1 cm. long, thin and brittle, loose, sparingly hispidulous, eciliate; inflorescence paniculate, very glandular, the ultimate divisions ending in spicate racemes; racemes oblong-ovoid, 1–2 cm. long, erect, sometimes geminate, thick but rather loosely-flowered; ocreolae funnelform, 3–3.5 mm. long, oblique, pubescent, ciliate; pedicels slender, 3 mm. long, angled; calyx light pink, 3–4 mm. long, five-parted to near the base, the segments oblong-ovate, obtusish; stamens usually eight, included or slightly exserted; style 1.3 mm. long, two-parted or three-parted to below the middle, included; achenes lenticular, biconvex, gibbous or triquetrous, 3 mm. long, broadly obovoid or very broadly oblong, short-pointed, black, smooth and shining.

San Luis Potosi, Mexico.



POLYGONUM PRINGLEI SMALL.

[PLATE 17.]

17. Polygonum Mexicanum Small.

Polygonum Pennsylvanicum Torrey, Bot. Mex. Bound. Surv. 178 (1859), not Linnaeus; S. Watson, Proc. Am. Acad. 18: 147.

Polygonum Mexicanum Small, Bull. Torr. Club, 19: 356 (1892).

Annual, slender, pale green, glabrous as far as the upper branches. Stem erect, 4-7 dm. tall, more or less branched, the upper parts slightly pubescent, becoming glandular about the inflorescence; leaves varying from linear-lanceolate to linear, 3-12 cm. long, .4-1 cm. broad, broad, firm, obscurely punctate, ciliate, inclined to be revolute, short-petioled; ocreae cylindric when young, .5-1.5 cm. long, thin, clasping the stem closely when young, at length becoming loose, sparsely hispidulous or nearly smooth, eciliate; inflorescence paniculate, pubescent or glandular, the ultimate divisions ending in spicate geminate racemes; racemes oblong, 1.5-3.5 cm. long, erect, densely flowered; ocreolae funnelform, 3 mm. long, very oblique, fringed with short bristles; pedicels 2.5-3 mm. long; calyx light rose color, 2-3 mm. long, five-cleft to the middle or to near the base; stamens six to eight, included; style 1-1.5 mm. long, two-parted to below the middle, somewhat exserted; achene lenticular, 3-4 mm. long, ovoid or broadly ovoid, flat, but inconspicuously gibbous on one side, thick-pointed, dark brown or nearly black, mostly granular and dull.

Southern Louisiana and southern Texas to Sonora, Jalisco, Michoacan and San Luis Potosi.



POLYGONUM MEXICANUM SMALL.

[PLATE 18.]

18. *Polygonum longistylum* Small.

Polygonum longistylum Small, Bull. Torr. Club, 1: 169 (1894).

Annual or perennial, slender, glabrous except the upper branches and peduncles. Stem erect, 3–6 dm. long, branched throughout, somewhat enlarged at the nodes, more or less channeled, becoming woody below; leaves varying from lanceolate to narrowly lanceolate or sometimes ovate-lanceolate, 3–10 cm. long, .5–2 cm. broad, acuminate at both ends, undulate, more or less ciliate, somewhat crisped, petioled; petioles .5–1.2 cm. long; ocreæ cylindric, or funnellform at branching nodes, truncate, entire, thin, brittle, soon falling away; inflorescence terminal, paniculate, glandular and pubescent, consisting of spicate often geminate racemes; racemes cylindric, 2–8 cm. long, 1 cm. thick, erect, many-flowered but not dense, conspicuous; ocreolæ funnel-form, 2–2.5 mm. long, their margins hyaline; pedicels slender, 3 mm. long, somewhat angled; calyx mostly lilac, 4 mm. long, five-parted to below the middle, the segments oblong, obtuse; stamens varying from six to eight, included; style 3–3.5 mm. long, two-parted to below the middle, slender, conspicuously exerted, the stigmas black; achene lenticular, 2.5 mm. long, broadly ovoid, long-pointed, slightly gibbous on the sides, dark brown or black, slightly granular, somewhat shining or dull.

Southern Missouri, south to Louisiana and New Mexico.



POLYGONUM LONGISTYLUM SMALL.

[PLATE 19.]

19. *Polygonum Pennsylvanicum* Linnaeus.

Polygonum Pennsylvanicum Linnaeus, Sp. Pl. 362 (1753); Gmelin, Syst. Nat. **2**: 638; Walter, Fl. Car. 132; Willdenow, Sp. Pl. 448; Michaux, Fl. Bor. Am. **1**: 240; Persoon, Syn. **1**: 440; Muhlenberg, Cat. 40; Pursh, Fl. Am. Sept. 271; Eaton, Man. 371; Elliott, Bot. S. C. and Ga. **1**: 457; Sprengel, Syst. **2**: 256; Barton, Comp. Fl. Phil. 187; Torrey, Fl. **1**: 404, Comp. 172, Fl. N. Y. **2**: 150; Beck, Bot. 302; Darlington, Florula Cest. 48, Fl. Cest. 250; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 387; Meisner, Monog. 69, in DC. Prodr. **14**: 120; Wood, Cl. Bk. Ed. 41, 474, Am. Bot. & Fl. 283; Chapman, Fl. S. States, 388; Darby, Bot. S. States, 489; S. Watson, Bot. Calif. **2**: 13; Coulter, Man. Bot. Rocky Mt. Reg. 319.

Annual, glabrous below, pubescent and glandular about the inflorescence and upper branches. Stems erect, 3–9 dm. high, simple or much branched throughout; leaves varying from narrowly to broadly lanceolate, 4–22 cm. long, .4–5 cm. broad, acuminate and somewhat unsymmetrical at the base, glabrous or the upper ones occasionally glandular beneath, ciliate, the midrib prominent on the lower side; petioles about 1 cm. long; ocreae cylindric or funnelform, 1–1.5 cm. long, rather thin, glabrous, brittle and ciliate; inflorescence paniculate, more or less simple, the ultimate divisions ending in spicate racemes; racemes oblong-cylindric, 2–5 cm. long, erect, dense; ocreolae funnelform, 3 mm. long, oblique, wide at the summit; pedicels 3–4 mm. long, angled; calyx pink or light purple, sometimes reddish, 3–4 mm. long, five-parted to or below the middle; stamens eight or fewer, included; style 3 mm. long, two-parted to about the middle, mostly included; achene lenticular, flat or sometimes slightly biconcave, 3–3.5 mm. long, mostly orbicular or broader than high, short-pointed, black, smooth and shining.

Nova Scotia to Florida, west to Minnesota, Nebraska and Kansas; also about Apam, Mexico, probably introduced.



POLYGONUM PENNSYLVANICUM LINNAEUS.

[PLATE 20.]

20. Polygonum Persicaria Linnaeus.

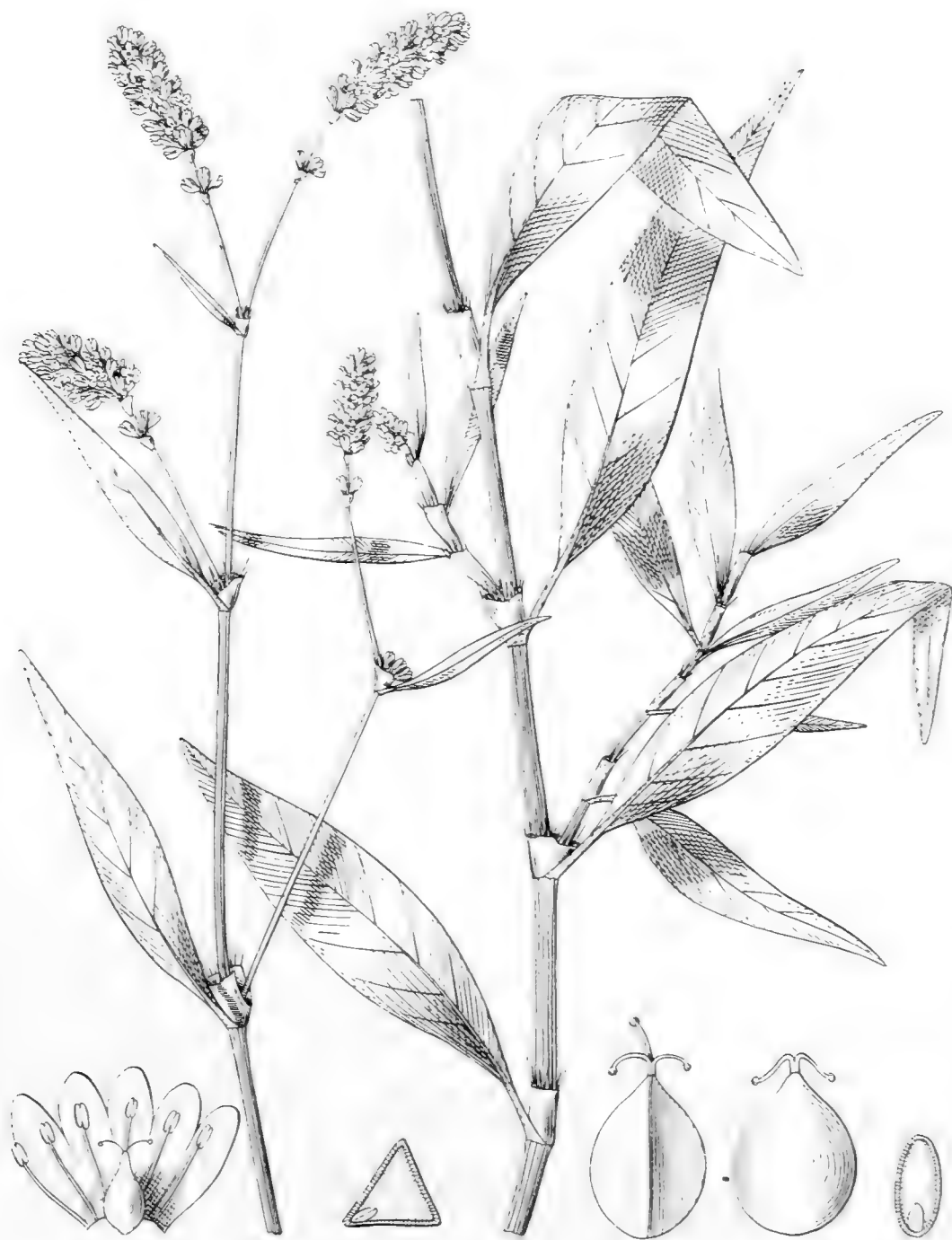
Polygonum Persicaria Linnaeus, Sp. Pl. 361 (1753); Gmelin, Syst. Nat. **2**: 638; Walter, Fl. Car. 131; Michaux, Fl. Bor. Am. **1**: 239; Persoon, Syn. **1**: 440; Bigelow, Fl. Bost. 94; Pursh, Fl. Am. Sept. 271; Muhlenberg, Cat. 40; Barton, Comp. Fl. Phil. 187; Eaton, Man. 371; Torrey, Fl. **1**: 405, Comp. 172; Sprengel, Syst. 257; Meisner, Monog. 68, in Mart. Fl. Bras. **5**: 16, in DC. Prodr. **14**: 117; Beck, Bot. 302; Darlington, Florula Cest. 48, Fl. Cest. 249; Hooker, Fl. Bor. Am. **2**: 132; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 387; Wood, Cl. Bk. Ed. 41, 474, Am. Bot. & Fl. 283; Gay, Fl. Chil. **5**: 266; Chapman, Fl. S. States, 389; S. Watson, Bot. Calif. **2**: 14; Greene, Fl. Francis. 136, Man. Bay Reg. Bot. 42.

Polygonum Persicaria var. *vernicosum* Chamisso & Schlechtendal, Linnaea, **3**: 43 (1828), Gay, Fl. Chil. **5**: 266.

Polygonum Persicaria var. *vulgare* Meisner, Monog. 68 (1826).

Annual, smooth or puberulent. Stem erect or sometimes spreading, 2–8 dm. long, simple or branched either at the base or above or throughout; leaves varying from lanceolate to linear-lanceolate, 2–18 cm. long, 3–3.5 cm. broad, acuminate at both ends, entire or sometimes eroded, often somewhat ciliate, conspicuously punctate, nearly smooth except the more or less hispid midrib and nerves, short-petioled or sessile, generally with a dark triangular or lunar spot in the middle; ocreae cylindric or funnelform, 1–1.5 cm. long, nearly smooth or with short hairs on the ridges, usually conspicuously fringed with short bristles; inflorescence paniculate, more or less compound, the ultimate divisions narrow spicate racemes; racemes oblong or ovoid, 1–3 cm. long, .5–1 cm. thick, mostly erect, densely flowered; ocreolae funnelform, 1.5–2 mm. long, oblique, smooth or nearly so, fringed with short bristles; pedicels 1–2 mm. long; calyx about 1.5 mm. long, varying from pink to dark purple or sometimes red or greenish, five-cleft to the middle, the segments obtuse; stamens generally six, included; style two or three-parted to below the middle or near the base, 1–2 mm. long; achenes lenticular, biconvex, often gibbous or triquetrous, 2–2.5 mm. long, broadly ovoid, pointed, black, smooth and shining.

Throughout temperate and tropical North and South America. Naturalized from Europe.



POLYGONUM PERSICARIA LINNAEUS.

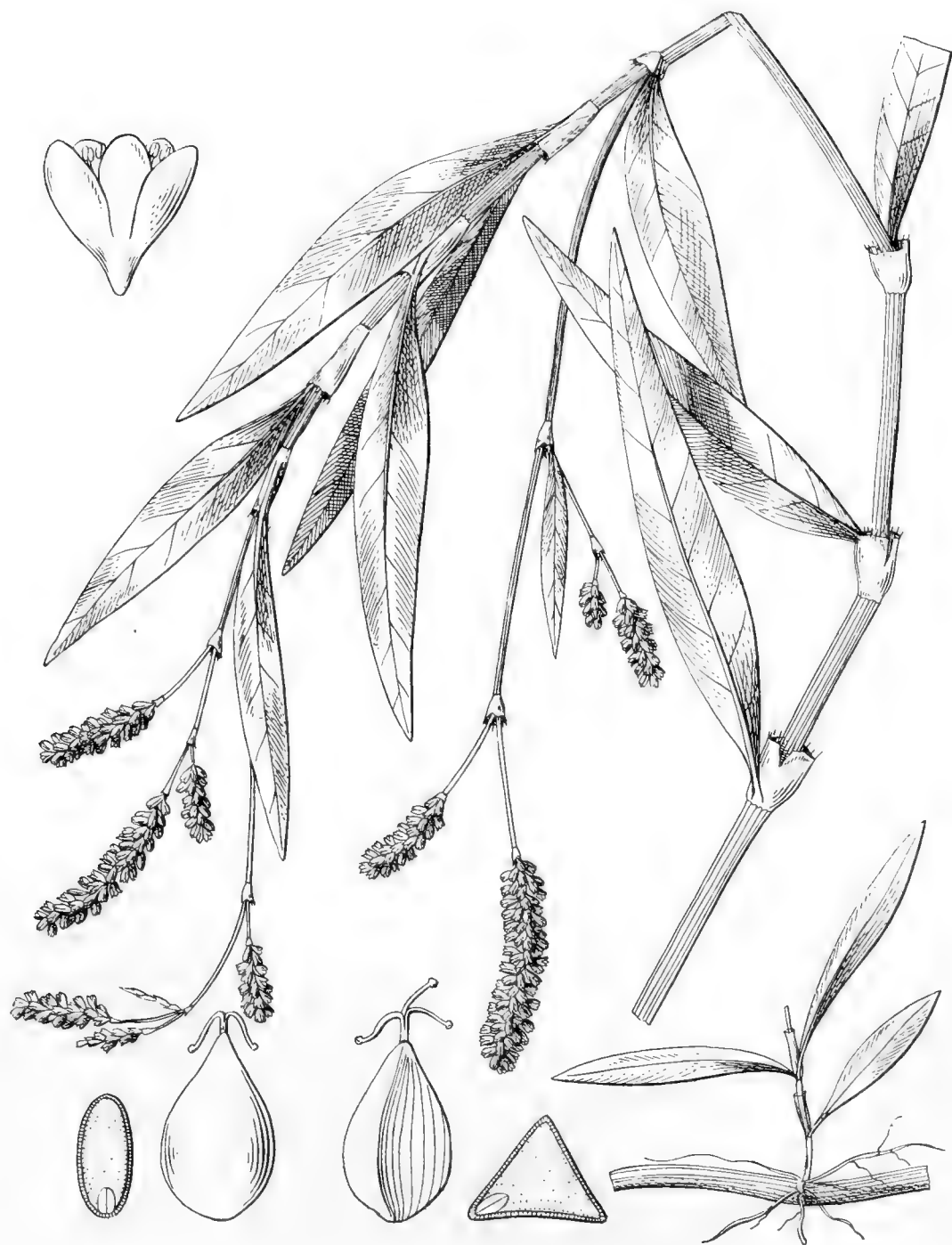
[PLATE 21.]

21. *Polygonum persicarioides* Humboldt, Bonpland & Kunth.

Polygonum persicarioides Humboldt, Bonpland & Kunth, Nov. Gen. **2**: 197 (1817); Sprengel, Syst. **2**: 257; Chamisso & Schlectendal, Linnaea, **3**: 44; Meisner, Monog. 69, in Mart. Fl. Bras. **5**: 16, and in DC. Prodr. **14**: 117.

Perennial, nearly glabrous or strigillose. Stem erect or decumbent and creeping, 3–7 dm. long, simple or branched either above or from the base; leaves lanceolate or often linear-lanceolate, 3–20 cm. long, .4–2 cm. broad, acuminate at both ends, glabrous or pubescent with scattered hairs, especially on the midrib, ciliate, punctate, short-petioled or sessile; ocreae cylindric or funnelform, 1–2 cm. long, glabrous or sparsely strigillose, inconspicuously fringed with short bristles; inflorescence paniculate, more or less compound, sometimes nearly simple, the ultimate divisions ending in narrow spicate racemes; racemes erect, 2–6 cm. long, narrowly oblong or linear, rather loosely flowered; ocreolae funnelform, oblique, 3 mm. long, fringed with a few short bristles or naked, often glandular or scurfy about the summit; pedicels about 3 mm. long, more or less angled; calyx 2–3 mm. long, rose color tinged with green, five-parted to below the middle, the segments oblong, obtuse; stamens eight or fewer, included; style 1–1.5 mm. long, two or three-parted to near the base; achenes lenticular, biconvex and more or less gibbous, or triquetrous, 2.5–3 mm. long, narrowly ovoid or sometimes broadly oblong, rather long-pointed, black, somewhat granular but shining.

Nebraska, Texas, New Mexico and Mexico, also in Bolivia, Chili, Paraguay and the Argentine Republic.



POLYGONUM PERSICARIOIDES HUMBOLDT, BONPLAND AND KUNTH.

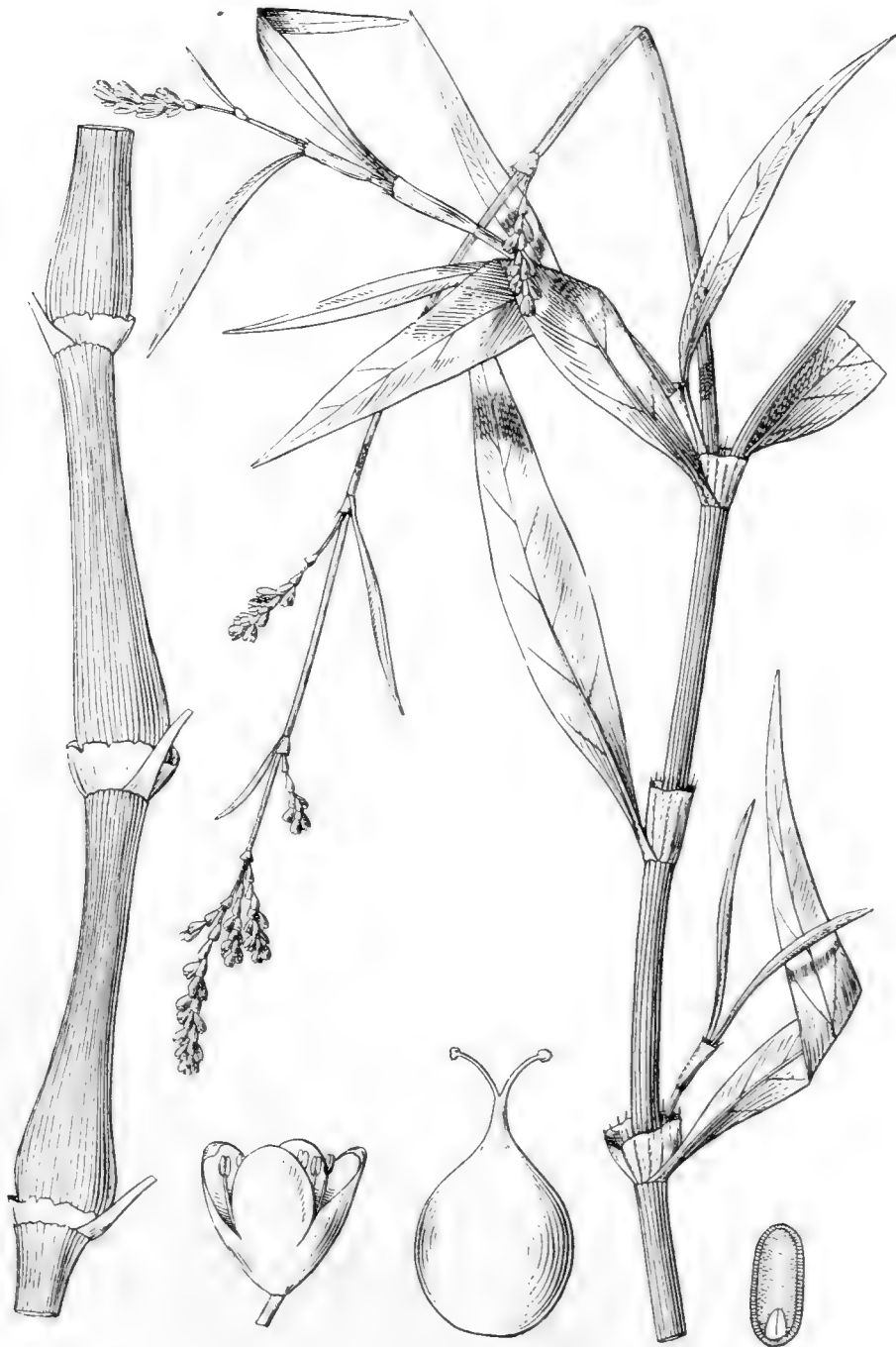
[PLATE 22.]

22. *Polygonum fusiforme* Greene.

Polygonum fusiforme Greene, Erythea, 1: 259 (1893).

Perennial, stout, nearly glabrous. Stems 9–20 dm. long, decumbent or assurgent, conspicuously enlarged above the nodes, more or less geniculate, dark red; internodes 6–8 cm. long when mature, papillose below the nodes; leaves lanceolate or narrowly lanceolate, 2–12 cm. long, 1–2 cm. broad, light green, acute or acuminate at both ends, subsessile, glabrous, more or less revolute; ocreae cylindric or funnelform, 1–2 cm. long, membranous and brittle, ciliolate or naked, the delicate ribs somewhat ciliate; inflorescence terminal, nearly simple or paniculate, the ultimate divisions being spicate racemes; racemes linear-oblong, 1–3 cm. long, not dense; ocreolae 2–2.5 mm. long, tinged with pink or rose color, nearly naked or ciliolate; pedicels about 2 mm. long, angled; calyx rose-colored or pinkish, 2–2.5 mm. long, four-parted to below the middle, the segments broadly oblong or nearly orbicular, obtuse, sometimes conspicuously punctate, the outer ones hooded at the apex and narrower than the inner; stamens four or five, included; style two-parted, included; achene ovoid-oblong, lenticular, 2–2.3 mm. long, thick-pointed, dark brown, smooth and shining, the angles obtuse, the faces plane.

Western Arizona near the Needles.



POLYGONUM FUSIFORME GREENE.

[PLATE 23.]

23. *Polygonum segetum* Humboldt, Bonpland & Kunth.

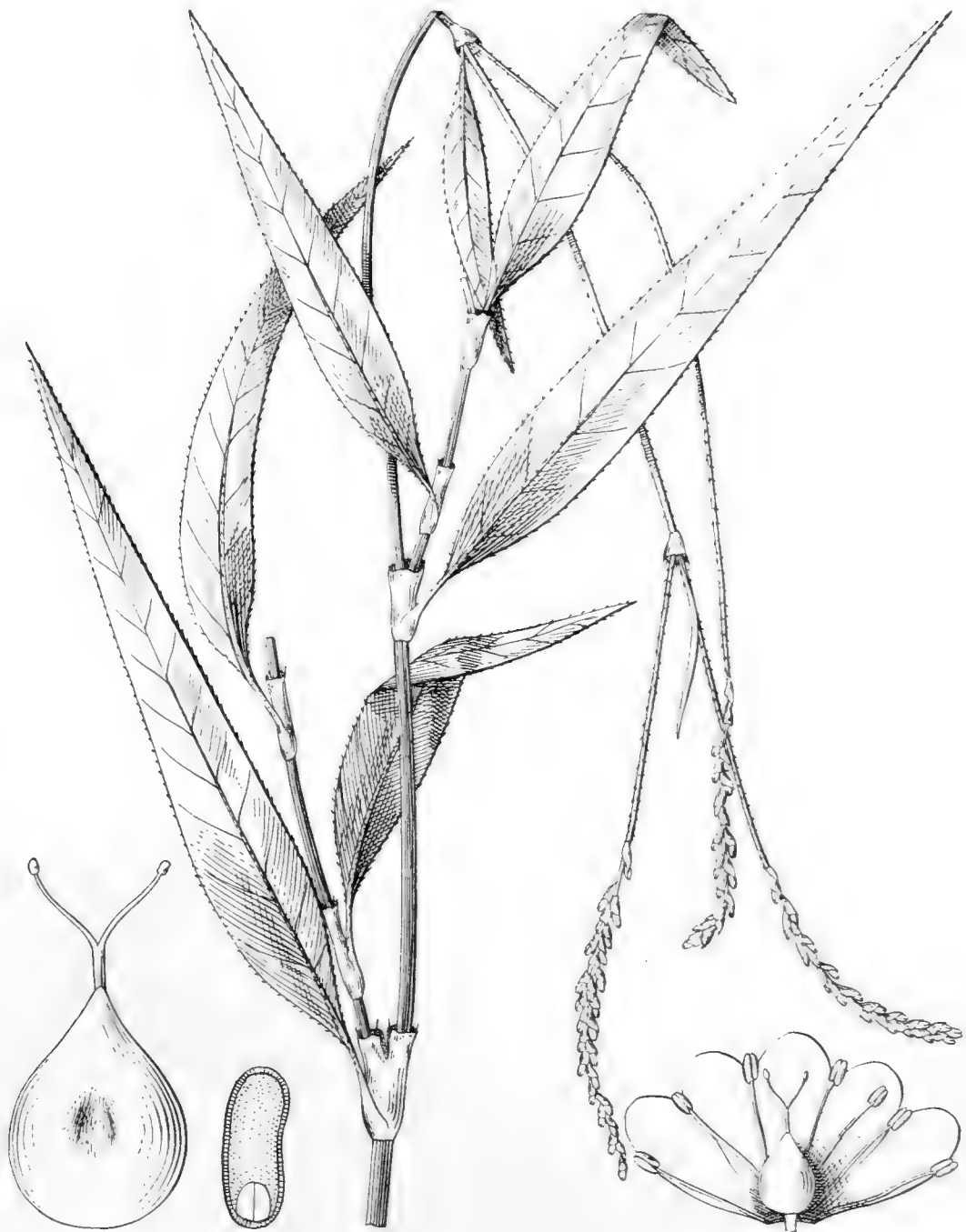
Polygonum segetum Humboldt, Bonpland & Kunth, Nov. Gen. **2**: 177 (1817); Sprengel, Syst. **2**: 257; Meisner, Monog. 67, in DC. Prodr. **14**: 120.

Polygonum Ludovicianum Meisner in DC. Prodr. **14**: 116 (1856).

Polygonum segetum var. *genuinum* Meisner in DC. Prodr. **14**: 121 (1856).

Perennial, glabrous below, pubescent or glandular about the inflorescence. Stem erect, 4–8 dm. long, simple or sparingly branched, enlarged at the nodes; leaves narrowly lanceolate, 6–16 cm. long, .7–1.5 cm. broad, acuminate at both ends, sometimes undulate and slightly crisped, glabrous except occasional short stout hairs on the midrib and the ciliate margin, not punctate, short-petioled; petioles about 1 cm. long; ocreae cylindric or narrowly funnelform, 1–1.5 cm. long, those on the lower part of the stem glabrous, the upper pubescent or glandular, especially about the inflorescence, naked or fringed with a few short bristles; inflorescence paniculate more or less compound, the ultimate divisions ending in spicate often geminate racemes; racemes erect, 2–4 cm. long, cylindric, rather loosely flowered; ocreolae funnelform, 2–2.5 mm. long, oblique, coriaceous with a somewhat membranous edge, more or less scurfy; pedicels at length about 3 mm. long, strongly angled; calyx 2–2.5 mm. long, five-parted to near the base, the segments oblong, obtuse; stamens six or seven, included; style about 1.5 mm. long, two-parted to below the middle; achene lenticular, 2.5 mm. long, ovoid, usually somewhat plano-concave, rather long-pointed, dark brown, minutely granular, dull.

Louisiana, Mexico and the West Indies; also in Colombia.



POLYGONUM SEGETUM HUMBOLDT, BONPLAND AND KUNTH.

[PLATE 24.]

24. *Polygonum Carey* Olney.

Polygonum Carey Olney, Proc. Prov. Frank. Soc. 1: 29 (1847); A. Gray, Man. 386; Meisner in DC. Prodr. 14: 111; Wood, Cl. Bk. Ed. 41, 368; Am. Bot. & Fl. 283.

Annual, pubescent and glandular throughout, usually slender. Stem erect, 6–12 dm. tall, simple or sparingly branched above, rough with stiff and glandular hairs, channeled; leaves varying from oblong-lanceolate to linear-lanceolate, 4–27 cm. long, .2–4.6 cm. broad, acuminate at both ends, hispid, especially about the midrib, ciliate, sparingly punctate, short-petioled or sessile, arising from about the middle of the ocreae, the uppermost often nearly linear; ocreae cylindric or funnelform, .8–1.7 cm. long, somewhat hispid, fringed with long bristles; inflorescence paniculate, the ultimate divisions very narrow, spicate racemes; racemes linear or linear-oblong, 2–6 cm. long, .4–.7 cm. broad, loosely flowered, drooping; ocreolae continuous, funnelform, oblique, 2–3 mm. long, sparingly hispid, fringed with stout bristles; pedicels at length 3–4 mm. long, somewhat angled; calyx about 2 mm. long, purplish, five-parted to below the middle, the segments strongly nerved and obtuse; stamens five or sometimes eight, included; style two-cleft to the middle, 1–1.5 mm. long, included; achene lenticular, 2–2.5 mm. long, broadly obovoid, strongly biconvex, short-pointed, black, very smooth and shining.

Maine to northeastern Pennsylvania and southern New Jersey.



POLYGONUM CAREYI OLNEY.



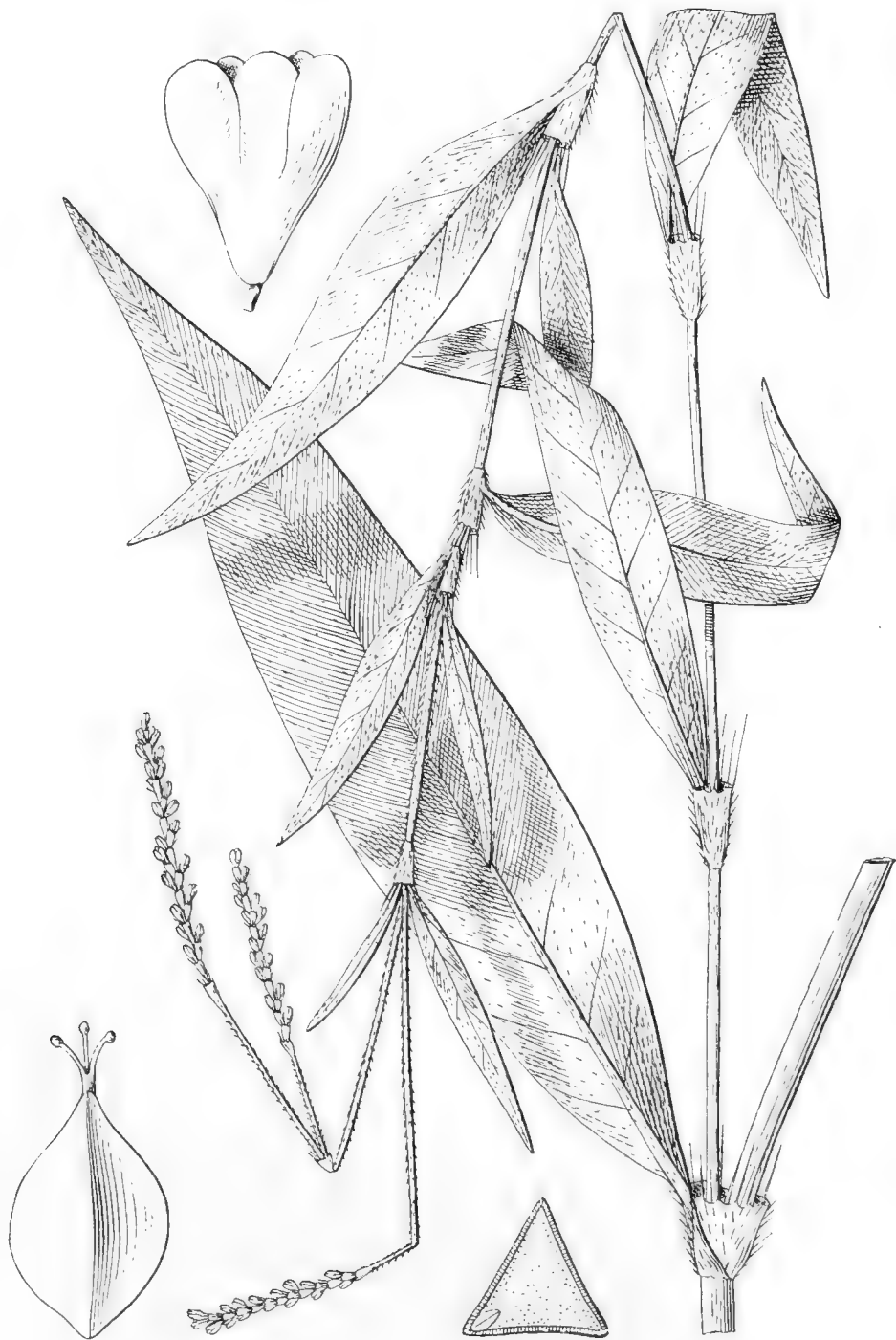
[PLATE 25.]

25. *Polygonum setaceum* Baldwin.

Polygonum setaceum Baldwin; Elliott, Bot. S. C. and Ga. **1**: 455 (1817); Sprengel. Syst. **2**: 253; Meisner, Monog. 79 and in DC. Prodr. **14**: 103; Eaton & Wright, N. A. Bot. Ed. 8, 368; Chapman, Fl. S. States, 389; Darby, Bot. S. States, 489.

Perennial, rather slender, more or less strigose throughout, at length woody below, Stem erect, 6–11 dm. long, strigose especially about the nodes, sometimes becoming nearly glabrous, simple or sparingly branched above, enlarged especially above the nodes; leaves oblong-lanceolate or narrowly lanceolate, 4–18 cm. long, .7–3 cm. broad, acuminate at both ends, strigose on both sides or occasionally nearly glabrous, except the midrib and nerves beneath, ciliate, inconspicuously but closely punctate; ocreae cylindric or funnelform at branching nodes, 1–1.5 cm. long, strigose, fringed with bristles often equaling them in length; inflorescence paniculate, usually quite simple, the ultimate divisions ending in spicate, more or less geminate racemes; racemes erect, 1–6 cm. long, almost linear, loosely flowered; ocreolae funnelform, slightly oblique, 2–2.5 mm. long, fringed with bristles, some of the bristles exceeding them in length; pedicels slender, at length 3–5 mm. long; calyx about 2 mm. long, white or pink, five-parted to a little below the middle, the segments ovate-oblong, obtuse; stamens eight, included; style three-parted to below the middle, 1 mm. or less long, at length protruding beyond the calyx; achene triquetrous, 2–3 mm. long, broadly oblong, obovoid or oblong-ovoid, somewhat rhomboidal, thick-pointed at both ends, black, minutely granular and rather dull or slightly shining.

Missouri and North Carolina to Texas, Louisiana and Florida.



POLYGONUM SETACEUM BALDWIN.

[PLATE 26.]

26. *Polygonum Opelousanum* Riddell.

Polygonum Opelousanum Riddell; Small, Bull. Torr. Club, **19**: 354 (1892).

Perennial, slender and rather strict. Stem erect or ascending, 3–9 dm. long, sparingly or considerably branched, glabrous, becoming woody below; leaves varying from linear-lanceolate to linear, 3–10 cm. long, .3–.7 cm. broad, glabrous or with a few stout hairs especially on or about the midrib, ciliate, sessile; ocreae cylindric or funnelform at branching nodes, 1–1.5 cm. long, strigose, fringed with long bristles; inflorescence paniculate, the ultimate divisions ending in spicate often more or less geminate racemes; racemes almost linear, 1.5–4 cm. long, erect, not densely flowered; ocreolae funnelform, 2.5 mm. long, slightly oblique, conspicuously fringed with long bristles; pedicels 2.5–3 mm. long, angled; calyx 1–1.5 mm. long, white, five-parted to below the middle, the segments oblong, obtuse; stamens eight or fewer, included; style three-parted to below the middle, about .6 mm. long; achene triquetrous or rarely tetragonous, about 2 mm. long, varying from broadly ovoid to obovoid, black, smooth and shining.

Southern Missouri and Indian Territory south to Louisiana, Texas and Mexico.



POLYGONUM OPELOUSANUM, RIDDELL.

[PLATE 27.]

27. *Polygonum hydropiperoides* Michaux.

Polygonum barbatum Walter, Fl. Car. 131 (1788)? not Linnaeus; Muhlenberg, Cat. 40; Elliott, Bot. S. C. and Ga. 1: 456; Sprengel, Syst. 2: 253; Eaton & Wright, N. A. Bot. Ed. 8, 368.

Polygonum hydropiperoides Michaux, Fl. Bor. Am. 1: 239 (1803); Pursh, Fl. Am. Sept. 270; Meisner, in Mart. Fl. Bras. 5: 17 and in DC. Prodr. 14: 103; Bigelow, Fl. Bost. 1: 156; A. Gray, Man. 387; Chapman, Fl. S. States, 389; Wood, Am. Bot. and Fl. 283.

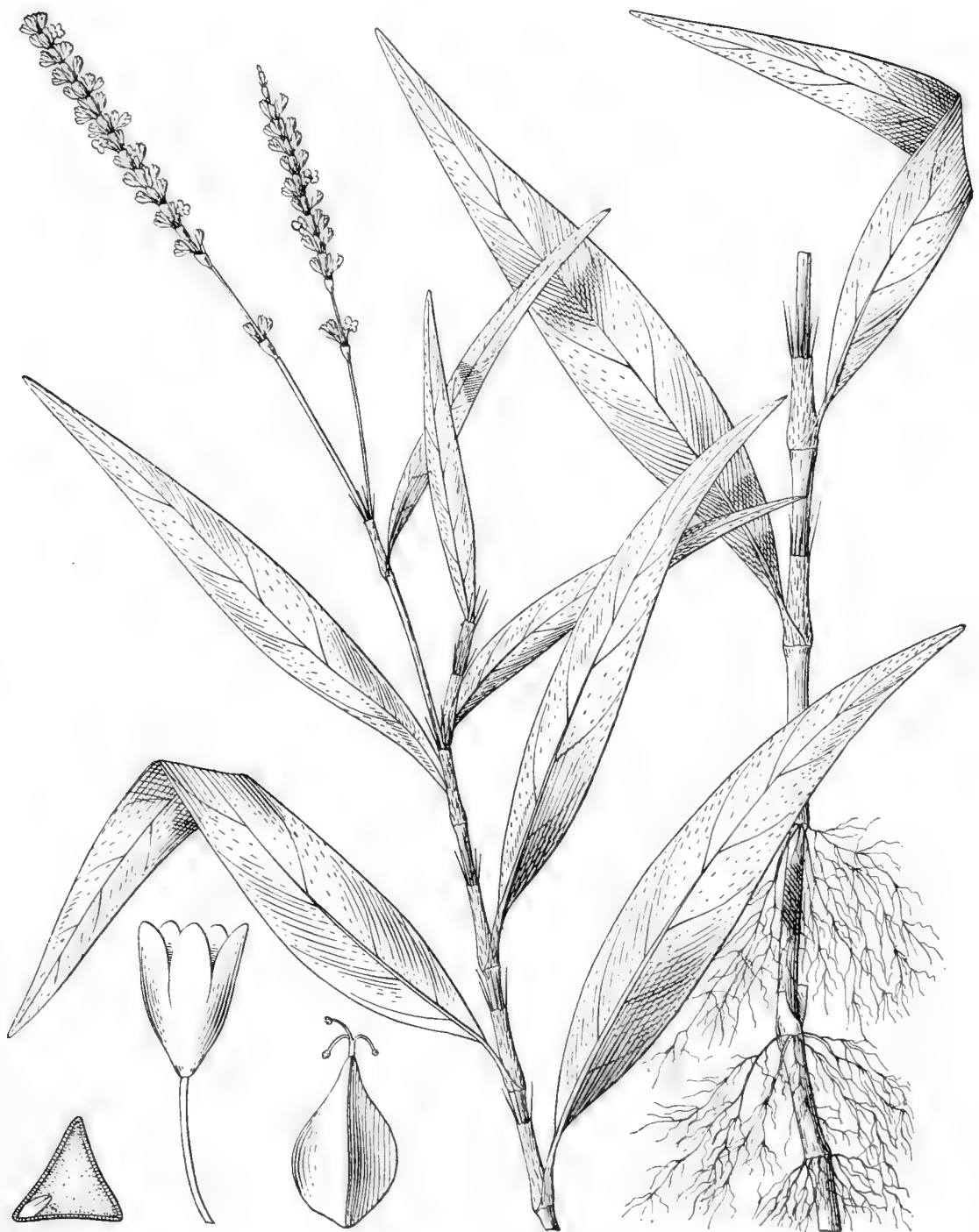
Polygonum mite Persoon, Syn. 1: 446 (1805), not Schrank; Pursh, Fl. Am. Sept. 270; Eaton, Man. 371; Elliott, Bot. S. C. and Ga. 1: 456; Torrey, Fl. 1: 402, Comp. 172, Fl. N. Y. 2: 150; Meisner, Monog. 75 and in Mart. Fl. Bras. 5: 17, as synonym; Sprengel, Syst. 2: 253; Darlington, Florula Cest. 48, Fl. Cest. 249; Beck, Bot. 301; Eaton & Wright, N. A. Bot. Ed. 8, 367; Wood, Cl. Bk. Ed. 41, 474; Darby, Bot. S. States, 489.

Polygonum virgatum Chamisso & Schlechtendal, Linnaea, 3: 45 (1828); Gay, Fl. Chil. 5: 268.

Polygonum hydropiperoides var. *virgatum* Meisner in Mart. Fl. Bras. 5: 17 (1855) and in DC. Prodr. 14: 103.

Perennial, glabrous or sometimes slightly strigillose, often tinged with red throughout. Stem erect or the base decumbent and creeping, 3–9 dm. long, nearly simple or branched above, glabrous or somewhat strigillose about the bases of the ocreae, enlarged at the nodes; leaves lanceolate or oblong-lanceolate, sometimes linear-lanceolate, 4–13 cm. long, .3–1.8 cm. broad, glabrous especially above or obscurely strigillose, acute at both ends, ciliate, papillose on the lower surface, arising from the base of the ocreae, short-petioled, the midrib clothed with short hairs; ocreae cylindric or funnellform at branching nodes, 1–1.8 cm. long, loose, strigose, fringed with long bristles; inflorescence paniculate, nearly simple or more or less compound, the ultimate divisions ending in spicate somewhat geminate racemes; racemes narrowly cylindric or almost linear, 3–6 cm. long, erect, more or less interrupted; ocreolae funnellform, 2.5–3 mm. long, oblique, fringed with short bristles; pedicels 2–3 mm. long; calyx about 2 mm. long, flesh-colored or sometimes greenish, five-parted to below the middle, the segments oblong or obovate, obtuse or acutish, glandular; stamens eight, included; style less than 1 mm. long, three-parted to below the middle, at length protruding beyond the calyx; achene triquetrous, about 3 mm. long, ovoid or broadly oblong, pointed at the apex, black, smooth and shining.

New Brunswick to California, south to Florida and Mexico. Also in Brazil.



POLYGONUM HYDROPIPEROIDES MICHAUX.

***Polygonum hydropiperoides* Macouni Small.**

Polygonum hydropiperoides var. *strigosum* Small, Bull. Torr. Club, **19**: 355 (1892), not *P. strigosum* R. Br.

More robust than the type. Stem stout, 3-10 dm. long, clothed with strigose hairs; leaves varying from oblong-lanceolate to narrowly lanceolate, obtuse, strigose or strigillose; ocreae rather longer than in the type, densely strigose and fringed with long conspicuous bristles; calyx white or whitish, often conspicuous.

Ontario, West Virginia, Indiana and California.

[PLATE 28.]

28. *Polygonum hirsutum* Walter.

Polygonum hirsutum Walter, Fl. Car. 132 (1788); Michaux, Fl. Bor. Am. 1: 239; Persoon, Syn. 1: 440; Muhlenberg, Cat. 41; Pursh, Fl. Am. Sept. 270; Elliott, Bot. S. C. and Ga. 1: 454; Sprengel, Syst. 2: 253; Meisner, Monog. 79 and in DC. Prodr. 14: 103; Eaton & Wright, N. A. Bot. Ed. 8, 369; Wood, Cl. Bk. Ed. 4, 475; Am. Bot. and Fl. 283; Chapman, Fl. S. States, 389; Darby, Bot. S. States, 489.

Polygonum hirsutum var. *dasyphyllum* Meisner, in DC. Prodr. 14: 103 (1856).

Perennial, conspicuously hispid with reddish or brown hairs. Stem erect or decumbent and creeping, 3–9 dm. long, simple or branched either above or from the creeping base, more or less densely clothed with spreading hispid hairs, becoming woody below; leaves lanceolate, 3–10 cm. long, .6–2 cm. broad, cordate or subcordate, acute at the apex, the upper ones acuminate, more or less hispid on both surfaces, ciliate, inconspicuously punctate, subsessile; ocreae cylindric, 1–1.5 cm. long, very hispid, fringed with many but rather short bristles; inflorescence paniculate, strict, the ultimate divisions ending in spicate more or less geminate racemes, sometimes nearly simple; racemes erect, 1.5–6 cm. long, narrow or almost linear, rather loosely flowered, sometimes interrupted; ocreolae funnellform, oblique, 2 mm. long, acute, fringed with a few bristles; pedicels about 3 mm. long, angled; calyx 2.5–3 mm. long, white, five-parted to below the middle, the segments oblong, obtuse; stamens eight or fewer, included; style three-parted to below the middle, 1 mm. long, often shorter; achene triquetrous, 2 mm. long, broadly obovoid or nearly oblong, short-pointed, black, smooth and shining.

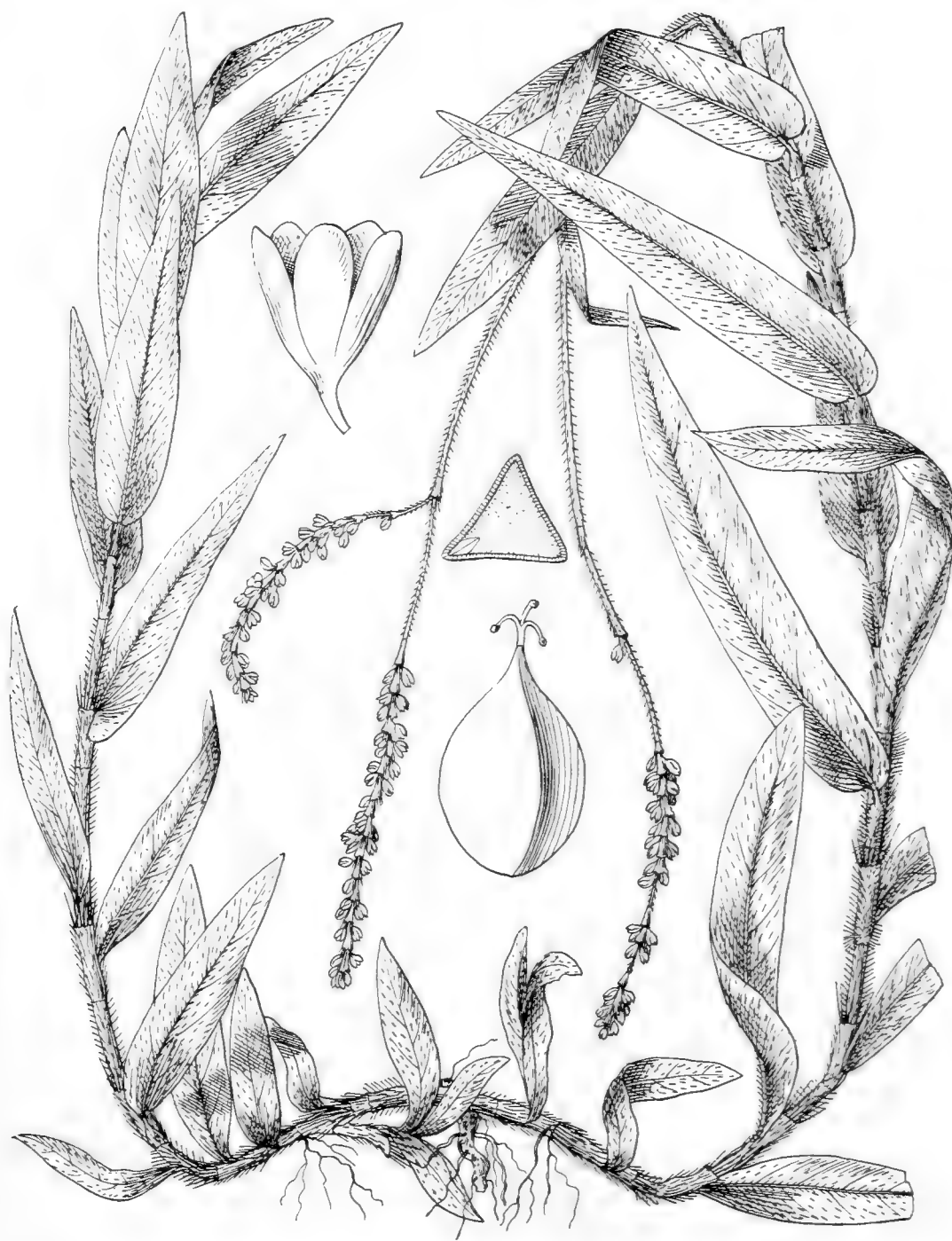
Wet soil, Florida and Georgia.

***Polygonum hirsutum glabrescens* Meisner.**

Polygonum hirsutum var. *glabrescens* Meisner, in DC. Prodr. 14: 103 (1856).

More slender than the species. Stem erect, 2–4 dm. long, glabrous or sparingly strigose especially about the nodes; leaves narrowly lanceolate, 3–6 cm. long, .5–1 cm. broad, glabrous except the midrib and a few straggling hairs on the upper and lower surfaces, obtuse; ocreae hispid.

Lake Jacnony and Tallahassee, Florida.



POLYGONUM HIRSUTUM WALTER.

[PLATE 29.]

29. Polygonum Hydropiper Linnaeus.

Polygonum Hydropiper Linnaeus, Sp. Pl. 361 (1753); Gmelin, Syst. Nat. **2**: 638; Michaux, Fl. Bor. Am. **1**: 238; Persoon, Syn. **1**: 440; Muhlenberg, Cat. 40; Bigelow, Fl. Bost. 93; Meisner, Monog. 76 and in DC. Prodr. **14**: 109; Hooker, Fl. Bor. Am. **2**: 132; Torrey, Fl. N. Y. **2**: 150; A. Gray, Man. 387; Wood, Am. Bot. and Fl. 283; S. Watson, Bot. Calif. **2**: 14; Coulter, Man. Bot. Rocky Mt. Reg. 320.

Polygonum punctatum Torrey, Fl. N. Y. **2**: 151 (1834), not Elliott.

Annual, glabrous, usually bright green. Stem erect or assurgent, 2-6 dm. long, lax, simple or branched throughout, sometimes red or reddish; leaves varying from ovate to oblong-lanceolate sometimes lanceolate, 1.5-9 cm. long, .3-2.3 cm. broad, acute at both ends or often acuminate at the apex, ciliate, more or less papillose, undulate or slightly crisped, punctate, containing a very acrid juice; ocreae cylindric, .5-1 cm. long, becoming somewhat funnelform and oblique, nearly glabrous, fringed with long bristles, usually enlarged about the bases, often bearing one or two flowers within; inflorescence paniculate, more or less compound, the ultimate divisions ending in spicate racemes; racemes linear, 2-6 cm. long, drooping, much interrupted; ocreolae funnelform, 1.5-2 mm. long, slightly oblique, fringed with a few short bristles; pedicels slender, 2 mm. long; calyx greenish, 2.5-3 mm. long, three to five-parted, usually four-parted, the segments rather narrowly oblong, obtusish, glandular; stamens four or sometimes six, included; style .5 mm. long, two or three-parted to near the base; achene lenticular, biconvex, slightly gibbous or triquetrous, 3 mm. long, broadly oblong or ovoid, sometimes orbicular or even broader than high, short-pointed, dark brown, strongly granular and dull.

Canada to Florida and westward across the continent. Naturalized from Europe southward and eastward, said to be native in the north and west.



POLYGONUM HYDROPIPER LINNAEUS.

[PLATE 30.]

30. *Polygonum minus* Hudson.

Polygonum minus Hudson, Fl. Angl. 148 (1762); Gmelin, Syst. Nat. **2**: 638; Meisner, in DC. Prodr. **14**: 111.

Polygonum pusillum Lamarek, Fl. Fr. **3**: 235 (1778); Meisner in Mart. Fl. Bras. **5**: 17, as synonym.

Polygonum strictum Allioni, Fl. Pedem. **2**: 206. *t. 68. f. 2* (1785); Meisner in Mart. Fl. Bras. **5**: 17, as synonym.

Annual, slender, dull-green, scurfy throughout. Stem lax, diffuse, 3–5 dm. long, sometimes procumbent and creeping, nearly simple or much branched, rather fleshy; leaves varying from lanceolate to linear or sometimes oblong, 2–8 cm. long, .2–1.5 cm. broad, unsymmetrical and often scythe-shaped, papillose and sparingly pubescent on the lower surface, especially about the midrib, ciliate, short-petioled; ocreae cylindric or slightly funnelform at branching nodes, 1 cm. long, sparingly strigose and fringed with a few short bristles; inflorescence paniculate, usually rather simple, the ultimate divisions ending in spicate racemes; racemes linear, 1–5 cm. long, lax, few-flowered, more or less interrupted at the base; ocreolae funnelform, 3 mm. long, somewhat oblique, fringed with short bristles; pedicels about 3.5 mm. long; calyx greenish, 2.5–3 mm. long, five-parted to below the middle; stamens eight or fewer, included; style .5 mm. long, two-parted nearly to the base, included; achenes lenticular, nearly 2 mm. long, broadly oblong, conspicuously biconvex or triquetrous and narrowly ovoid-oblong, black, smooth and shining.

Louisiana and Chili. Introduced from Europe.



POLYGONUM MINUS HUDSON.

[PLATE 31.]

31. *Polygonum punctatum* Elliott.

Polygonum punctatum Elliott, Bot. S. C. and Ga. **1**: 445 (1817); Eaton, Man. 370; Barton, Comp. Fl. Phil. 187; Torrey, Fl. **1**: 402, Comp. 171; Sprengel, Syst. **2**: 253; Darlington, Florula Cest. 48, Fl. Cest. 248; Beck, Bot. 301; Eaton & Wright, N. A. Bot. Ed. 8, 367; Wood, Cl. Bk. Ed. 41, 474; Meisner in Mart. Fl. Bras. **5**: 18; Darby, Bot. S. States, 489.

Polygonum Hydropiper Michaux, Fl. Bor. Am. **1**: 238 (1803), not Linnaeus.

Polygonum hydropiperoides Pursh, Fl. Am. Sept. 270 (1814), not Michaux.

Polygonum acre Humboldt, Bonpland & Kunth, Nov. Gen. **2**: 179 (1817), not Lamarck; Meisner, Monog. 77, in Mart. Fl. Bras. **5**: 18 and in DC. Prodr. **14**: 107; Sprengel, Syst. **2**: 253; A. Gray, Man. 373; Chapman, Fl. S. States, 389; Wood, Am. Bot. and Fl. 283; Grisebach, Fl. Br. W. Ind. 161; S. Watson, Bot. Calif. **2**: 14; Reade, Pl. Bermuda. 69; Greene, Fl. Francis. 136, Man. Bay Reg. Bot. 42.

Polygonum antihæmorrhoidale Martius, Reise, **2**: 550 (1823); Meisner in Mart. Fl. Bras. **5**: 18.

Polygonum antihæmorrhoidale var. *aquatile* Martius, Reise, **2**: 550 (1823); Meisner in Mart. Fl. Bras. **5**: 18. *t. 5. f. 1.*

Polygonum antihæmorrhoidale var. *riparium* Martius, Reise, **2**: 550 (1823); Meisner in Mart. Fl. Bras. **5**: 18. *t. 5. f. 2.*

Polygonum maritimum Vellozo, Fl. Flum. **4**: *t. 39* (1827)?

Polygonum acre var. *confertiflorum* Meisner in DC. Prodr. **14**: 108 (1856).

Annual or perennial, mostly glabrous throughout. Stem erect or ascending, rarely creeping, 3–11 dm. long, simple or much branched; leaves varying from lanceolate to narrowly lanceolate, often oblong-lanceolate, 2–16 cm. long, .6–3.7 cm. broad, acuminate at both ends, usually glabrous, conspicuously punctate, often bearing a few short hairs on the midrib, ciliate, short-petioled; ocreae cylindric on the younger parts, broken and obliquely funnelform on the older portions, 1–1.5 cm. long, glabrous or sometimes sparingly strigillose, fringed with rather long bristles; inflorescence paniculate, the ultimate divisions ending in spicate racemes; racemes linear, 1–6 cm. long, erect or rarely slightly drooping, somewhat interrupted below, loosely flowered; ocreolae funnelform, 2.5–3 mm. long, fringed with a few short bristles, mostly imbricated; pedicels 3–4 mm. long, slender; calyx greenish, about 2 mm. long, five-parted to below the middle, conspicuously glandular, the segments oblong or ovate, obtuse, punctate; stamens eight, included; style



POLYGONUM PUNCTATUM ELLIOTT.

.3-.4 mm. long, two-parted or three-parted to the base; achenes lenticular, biconvex, slightly gibbous, or triquetrous, 2.5 mm. long, broadly-oblong, narrower when triquetrous, thick-pointed, black, smooth and shining.

From Ottawa to California, south to Colombia, Brazil and Paraguay. Also in the West Indies.

***Polygonum punctatum leptostachyum* (Meisner) Small.**

Polygonum acre var. *leptostachyum* Meisner in DC. Prodr. 14: 108 (1856).

Polygonum punctatum var. *leptostachyum* Small, Bull. Torr. Club, 19: 356 (1892).

Slender and somewhat smaller than the species. Stem erect, 3-4 dm. long, slender; leaves mostly lanceolate, 3-8 cm. long, .5-2 cm. broad; racemes very slender, 4-20 cm. long, much interrupted except near the summit; ocreolae distant, not imbricated.

Vermont to California, south to Florida and Mexico. Also in New Granada.

***Polygonum punctatum robustior* Small.**

Polygonum punctatum robustior Small, Bull. Torr. Club 21: 477 (1894).

Robust, of a rather dull green color. Stem erect, 4-7 dm. long, often with a creeping base; leaves oblong or lanceolate, 3-17 cm. long, .5-4 cm. broad, the lower surface paler than the upper; ocreae 1-1.5 cm. long, somewhat strigillose, fringed with long bristles, loose, inflated about the nodes; ocreolae contiguous or imbricated, entire; pedicels 3-4 mm. long; achene triquetrous, 3-4 mm. long, broadly oblong, smooth and shining.

In the Atlantic States from Massachusetts to Florida, Central America and north-eastern South America.

***Polygonum punctatum eciliatum* Small.**

Polygonum punctatum var. *eciliatum* Small, Bull. Torr. Club 20: 214 (1893).

Rather stout and more robust than the species, less scurfy throughout. Stem erect, 6-9 dm. long, much branched; leaves lanceolate or oblong-lanceolate, 3-12 cm. long, .5-3 cm. broad, less punctate than in the normal form; ocreae 1-2 cm. long, loose, bearing no bristles; racemes 3-6 cm. long, these as well as the adjacent part of the inflorescence of a dark reddish-purple color; achene triquetrous, 3.5 mm. long, broadly oblong, finely but plainly reticulated.

Tennessee and Mexico.

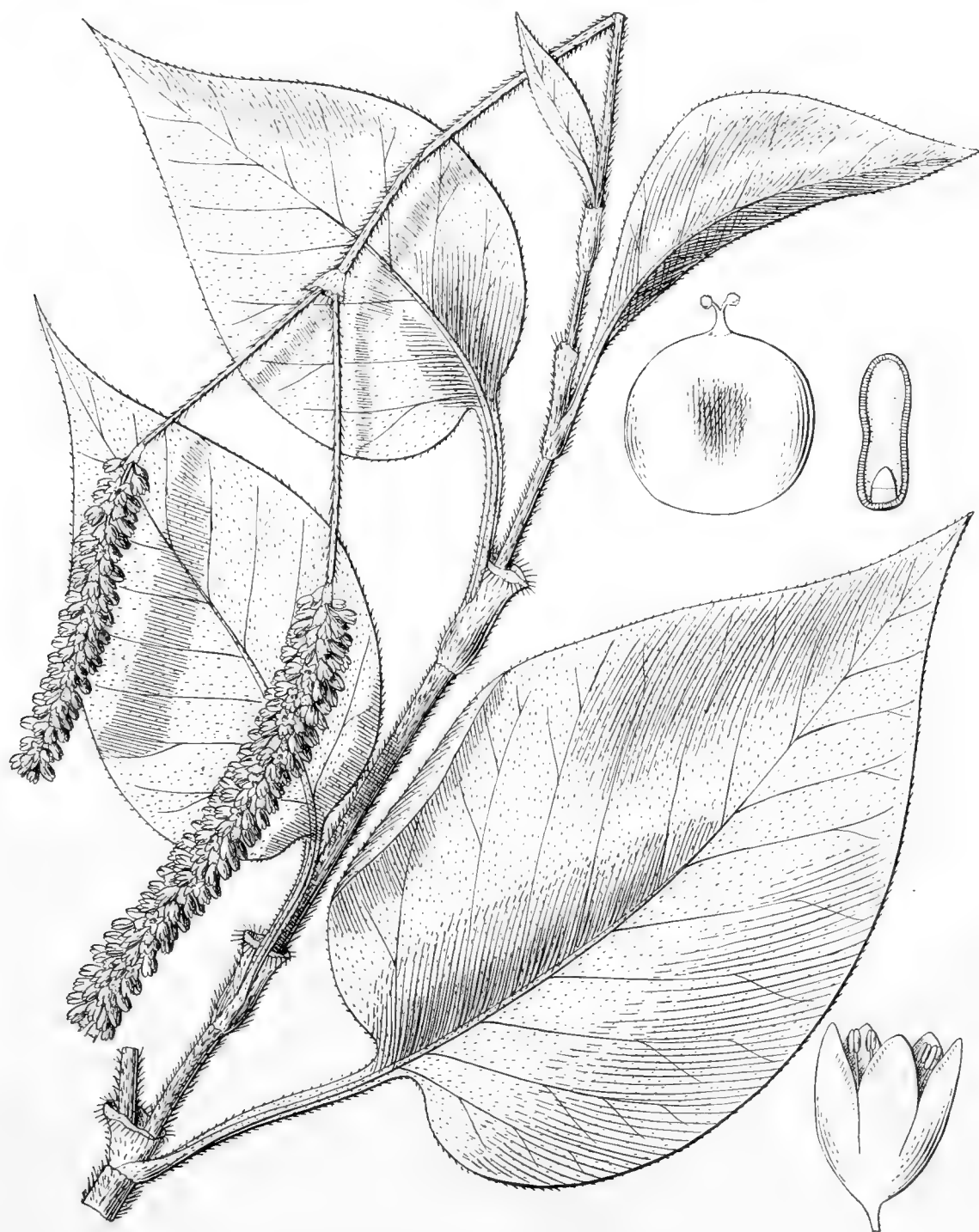
[PLATE 32.]

32. *Polygonum orientale* Linnaeus.

Polygonum orientale Linnaeus, Sp. Pl. 362 (1753); Gmelin, Syst. Nat. **2**: 638; Persoon, Syn. **1**: 440; Muhlenberg, Cat. 40; Pursh, Fl. Am. Sept. 272; Eaton, Man. 371; Elliott, Bot. S. C. and Ga. **1**: 457; Barton, Comp. Fl. Phil. 188; Sprengel, Syst. **2**: 257; Torrey, Fl. **1**: 405, Comp. 173, Fl. N. Y. **2**: 146; Meisner, Monog. 53 and in DC. Prodr. **14**: 123; Beck, Bot. 302; Darlington, Fl. Cest. 251; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 386; Wood, Cl. Bk. Ed. 41, 475, Am. Bot. and Fl. 283; Chapman, Fl. S. States, 388; Darby, Bot. S. States, 489.

Annual, large, more or less hispid. Stem stout, erect, 4–25 dm. tall, terete, becoming woody below, branching above; leaves ovate or broadly oblong, 6–25 cm. long, 1.5–15 cm. broad, acuminate, varying from acute to cordate at the base, ciliate, hispidulous on the midrib and its lateral branches on both surfaces; petioles 2–8 cm. long, slightly winged; ocreae cylindric or funnelform at branching nodes, 1–3 cm. long, loose, with or without a spreading border at the summit, ciliate; inflorescence paniculate, the ultimate divisions ending in spicate more or less geminate racemes; racemes varying from oblong to linear, 3–10 cm. long, drooping or sometimes suberect, often slightly interrupted near the base; ocreolae funnelform, 3–5 mm. long, very oblique, ciliate; pedicels slender, 5 mm. long; calyx dark rose-colored, 4–4.5 mm. long, five-cleft to or below the middle; stamens seven, exserted or included; style about 1 mm. long, two-cleft to above the middle, ending in two large stigmas, included; achene lenticular, 3 mm. long, orbicular or broader than high, thickened laterally about the base, biconcave, minutely granular and rather dull.

A native of India. Naturalized in waste places.



POLYGONUM ORIENTALE LINNAEUS.

[PLATE 33.]

33. *Polygonum Virginianum* Linnaeus.

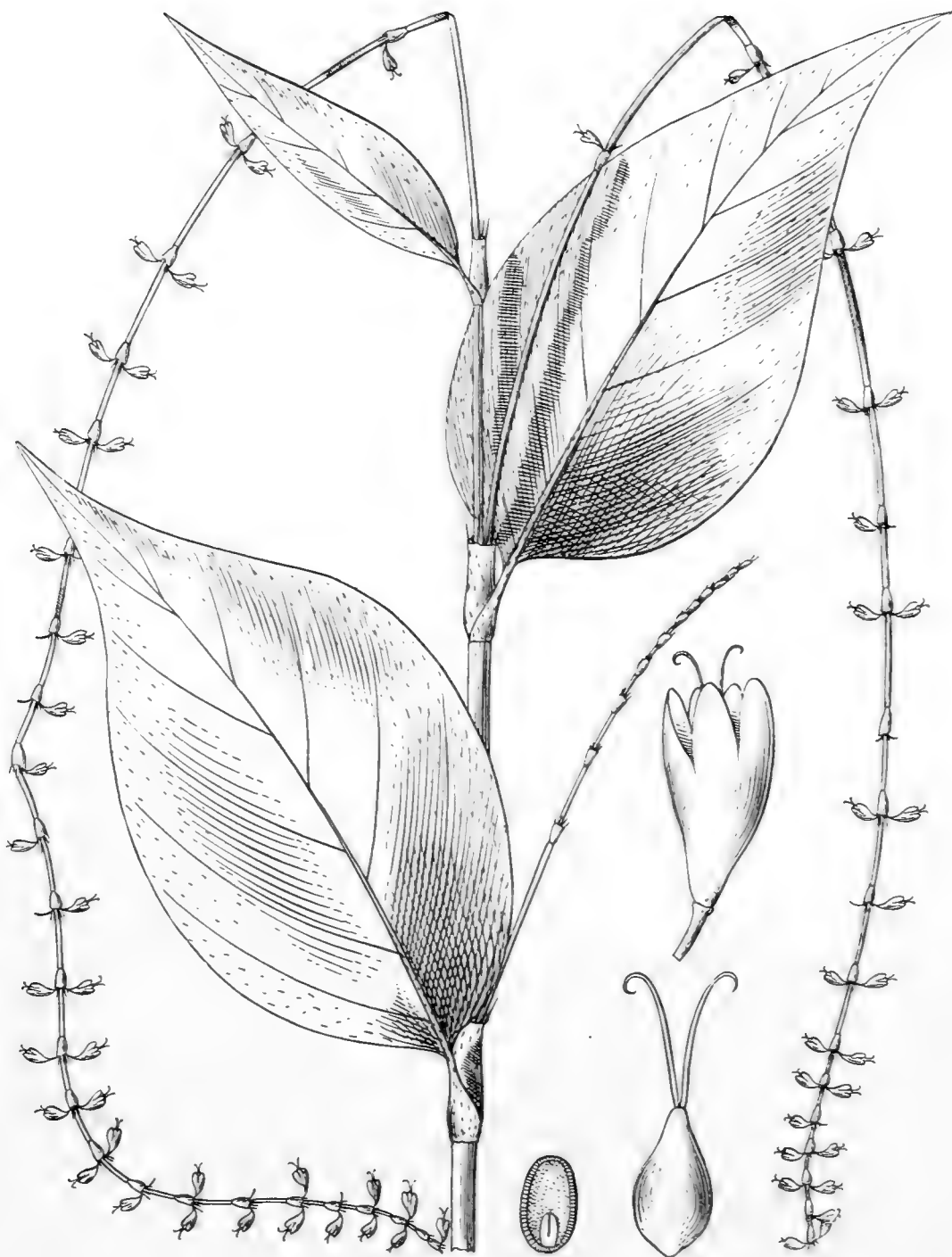
Polygonum Virginianum Linnaeus Sp. Pl. 360 (1753); Gmelin, Syst. Nat. **2**: 637; Willdenow, Sp. Pl. **2**: 442; Michaux, Fl. Bor. Am. **1**: 238; Persoon, Syn. **1**: 440; Muhlenberg, 40; Pursh, Fl. Am. Sept. 270; Bigelow, Fl. Bost. 167; Elliott, Bot. S. C. and Ga. **1**: 454; Eaton, Man. 371; Barton, Comp. Fl. Phil. **1**: 187; Sprengel, Syst. **2**: 259; Torrey, Fl. **1**: 403, Comp. 172, Fl. N. Y. **2**: 151; Beck, Bot. 301; Hooker, Fl. Bor. Am. **2**: 132; Meisner, Monog. 81 and in DC. Prodr. **14**: 112; Darlington, Florula Cest. 48, Fl. Cest. 248; Eaton & Wright, N. A. Bot. Ed. 8, 367; A. Gray, Man. 389; Wood, Cl. Bk. Ed. 41, 475, Am. Bot. and Fl. 283; Chapman, Fl. S. States, 390; Darby, Bot. S. States, 489.

Polygonum muticum Moench, Suppl. 266 (1802).

Persicaria Virginiana Gaertner, Fruct. et Sem. **2**: 180. *t.* 119 (1802).

Annual, slender, nearly glabrous or strigose throughout. Stem erect or reclining, 3–13 dm. long, virgate, simple or virgately branched especially above; leaves ovate, elliptic-ovate or ovate-lanceolate, 3–16 cm. long, 1–8 cm. broad, acuminate, short-petioled, acute at the base, sparingly ciliate, the upper surface dark green, the lower lighter; petioles 1–2.5 cm. long; ocreae cylindric, .5–1.5 cm. long, strigose, fringed with short bristles; inflorescence terminal and axillary, consisting of much elongated spicate racemes; racemes 1–6 dm. long, naked, much interrupted, virgate; ocreolae funnelform, 2 mm. long, fringed with short bristles; pedicels 3 mm. long, somewhat reflexed, conspicuously articulated at the base of the calyx; calyx greenish, 4–5 mm. long, unequally four-parted to the middle or to the base, somewhat curved; stamens five, included; style 4 mm. long, two-parted to the base, long exserted, the segments reflexed and curled at the tips; achene lenticular, 3.5–4 mm. long, ovoid-oblong, dark brown or cream-colored, smooth and shining.

Nova Scotia to Minnesota, south to Nebraska, Texas and Florida.



POLYGONUM VIRGINIANUM LINNAEUS.



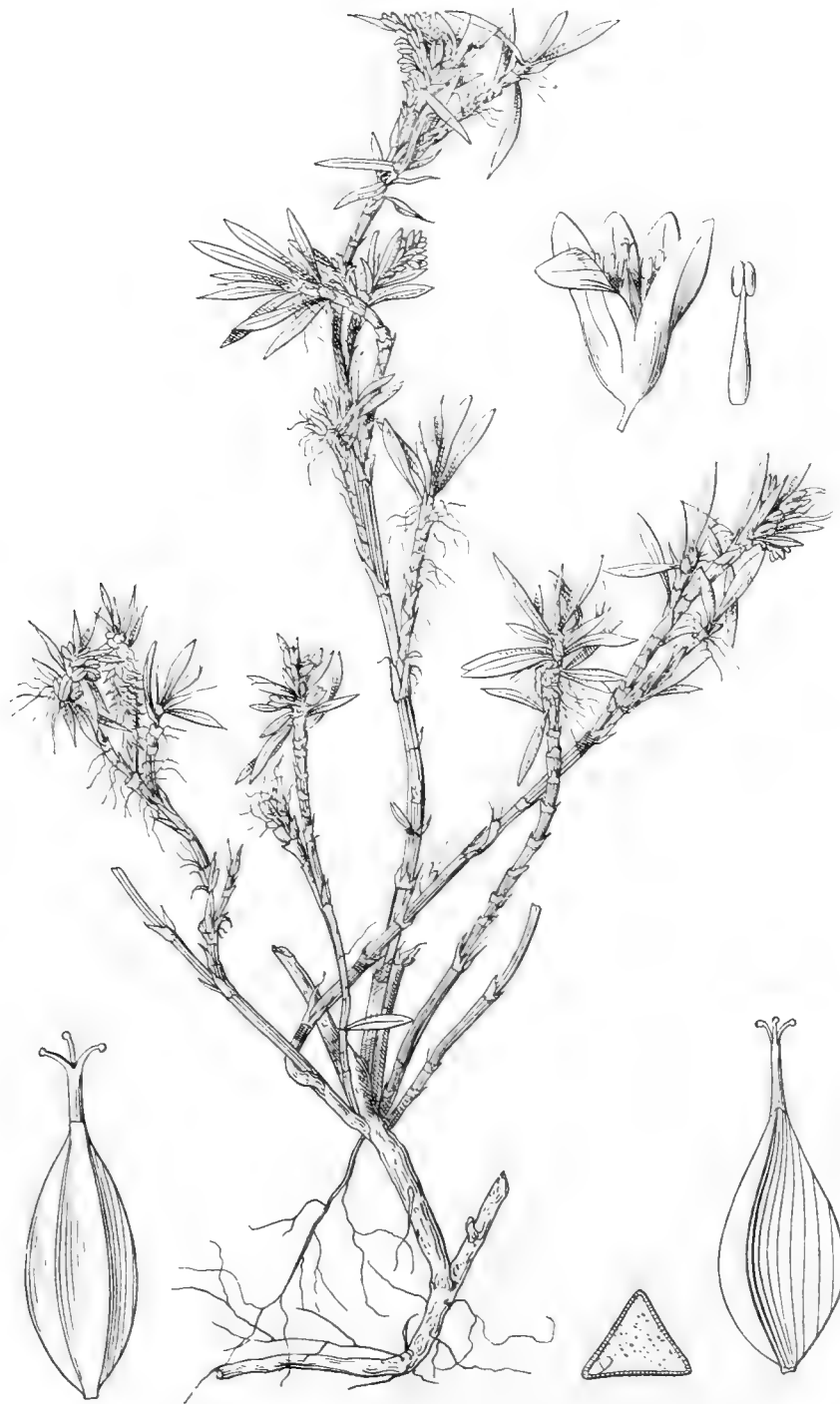
[PLATE 34.]

34. *Polygonum Paronychia* Chamisso & Schlechtendal.

Polygonum Paronychia Chamisso & Schlechtendal, *Linnaea*, **3**: 51 (1828); Hooker, *Fl. Bor. Am.* **2**: 132; Meisner in *DC. Prodr.* **14**: 89; S. Watson, *Bot. Calif.* **2**: 10; Behr, *Fl. San Francisco*, 275; Greene, *Fl. Francis.* 133.

Perennial, suffruticose, glabrous, bright green and glaucous throughout. Stem prostrate or ascending or both, 3–9 dm. long, diffusely and irregularly branched from the base and throughout, the older portions covered with a loose scaly bark and the persistent ocreae; leaves oblong or oblong-lanceolate, .5–2.5 cm. long, .3–.8 cm. broad (apparently linear or linear-lanceolate on account of the strongly revolute margins) scattered along the stem and branches or crowded in subcapitate clusters at the ends of the branches, sessile, pitted on the upper surface, acute or acuminate at the base, with a broad two-winged keel on the midrib beneath, articulated at the junction with the ocreae, the margins and wings of the keel more or less ciliate; ocreae funnelform, 1–1.7 cm. long, mostly contiguous, early lacerate, silvery, the segments becoming hair-like with age, and the bases turning brown; inflorescence axillary, consisting of clusters bearing several flowers, crowded into subcapitate clusters near the ends of the branches; pedicels 3 mm. long; calyx white, 5–7 mm. long, five-parted to below the middle or near the base, the segments obovate or oblong, dark-veined; stamens eight, included; style 1.5–1.8 mm. long, equally or unequally cleft to above the middle, included; achene triquetrous, 4.5–5 mm. long, sometimes approaching a tetragonous form by a conspicuous groove in place of one of the angles, somewhat rhomboidal, ovoid or oblong, black, smooth and shining.

On or near the coast from Santa Cruz, California, north to Vancouver Island.



POLYGONUM PARONYCHIA CHAMISSE & SCHLECHTENDAL.

[PLATE 35.]

35. *Polygonum Shastense* Brewer.

Polygonum Shastense Brewer in A. Gray, Proc. Am. Acad. 8: 400 (1872); S. Watson Am. Nat. 7: 664, Bot. Calif. 2: 11; Greene, Fl. Francis. 133.

Perennial by a large and thick root, stout, woody, glabrous throughout. Stem prostrate or ascending, 1-3 dm. long, much branched from the base and throughout, covered with a loose scaly bark, naked below, leafy for about 5 cm. from the ends of the branches, internodes very short; leaves oblong or oblanceolate, .5-1 cm. long, .3-.5 cm. broad, obtuse or acutish, sessile, acuminate or acute at the base, more or less plicate with two lateral impressions, conspicuously articulated at the junction with the ocreae; ocreae funnelform, 4-7 mm. long, two-parted, sometimes contiguous and imbricated, inconspicuous, the segments acute, very thin and silvery, the upper parts either falling away or becoming lacerate; inflorescence axillary, consisting of clusters of two or three flowers; pedicels 2-2.5 mm. long; calyx rose-colored or red, 4 mm. long, five-parted to near the base, the segments obovate, obtuse, each with a dark rib; stamens eight, included; filaments strongly dilated at the base; style .4 mm. long, three-parted, apparently formed by the splitting of the apex of the achene, the divisions spreading; achene triquetrous, 3.5-4 mm. long, narrowly oblong or ovoid, acuminate at both ends, chestnut-colored, smooth and shining.

Alpine parts of the Sierra Nevada in California.



POLYGONUM SHASTENSE BREWER.



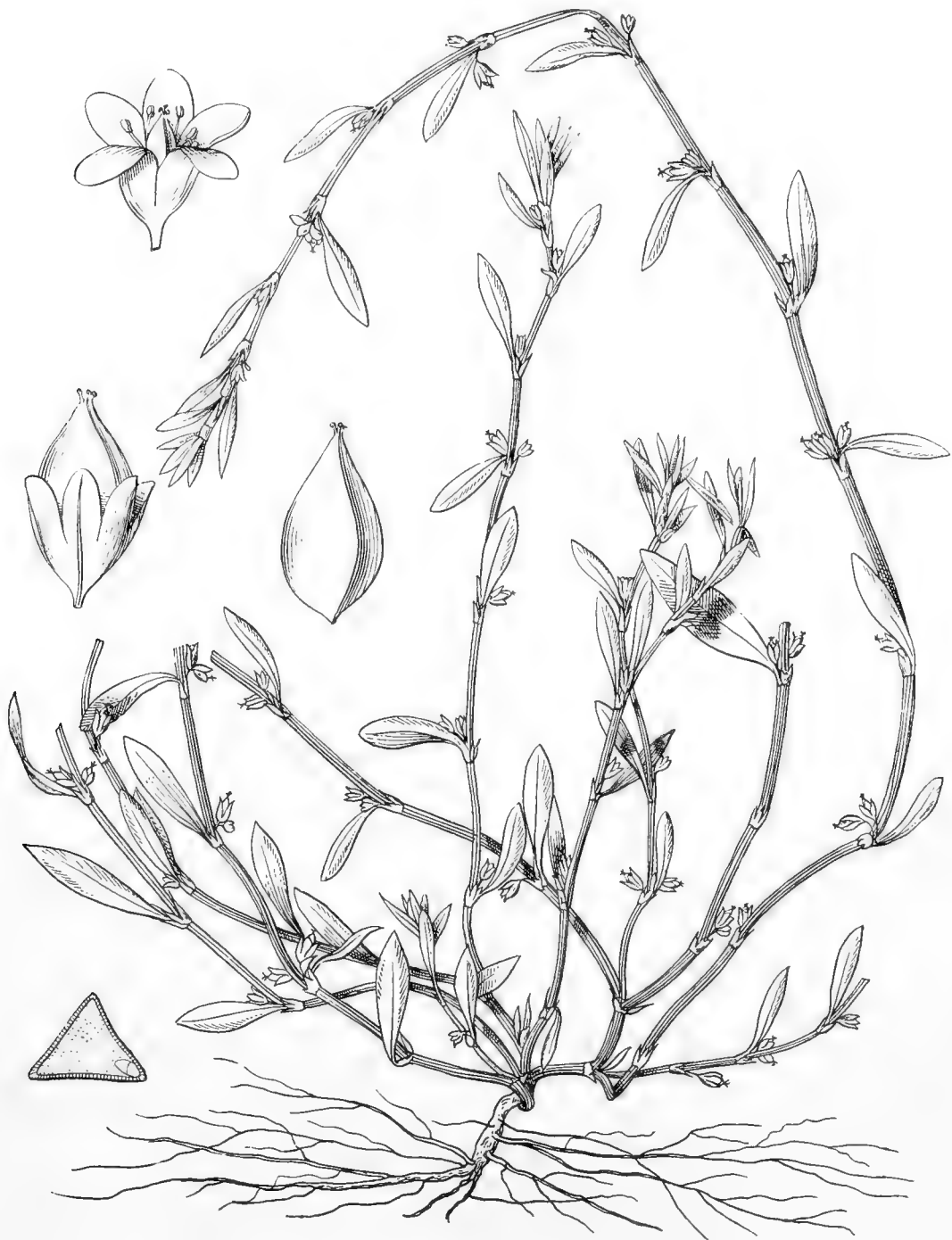
[PLATE 36.]

36. *Polygonum Rayi* Babington.

Polygonum Rayi Babington, Man. Brit. Bot. Ed. 2, 275 (1847); Meisner in DC. Prodr. 14: 88.

Perennial or annual, glabrous, glaucescent throughout or sometimes bright green. Stem prostrate, .5-6 dm. long, ridged, simple or much branched either from the base or throughout, slender or stout; leaves varying from ovate to ovate-lanceolate or oblong, .5-4 cm. long, .2-1 cm. broad, shorter than the internodes, except on young branches, rather thin or somewhat fleshy, usually flat, acute or obtusish, sometimes inconspicuously sub-parallel nerved above, acuminate at the base, not revolute, articulation at the ocreae not prominent; ocreae funnelform, oblique, .5-.8 cm. long, two-parted, at length lacerate, silvery, becoming fuscous and glaucous at the base; inflorescence axillary, consisting of clusters bearing from two to five flowers; pedicels slender, 3-4 mm. long; calyx 4 mm. long, five-parted to below the middle, the segments oblong, obtuse, sub-petaloid, with whitish borders; stamens eight, included; style 5 mm. long, three-parted to the base; achene triquetrous, 3.5-5.5 mm. long, ovoid, inclined to be acute, dark chestnut-colored, slightly granular but mostly shining, conspicuously surpassing the calyx.

Prince Edward's Island and New Brunswick to Vancouver Island, southward along the Atlantic coast to Virginia. Probably naturalized from Europe.



POLYGONUM RAYI BABINGTON.



[PLATE 37.]

37. *Polygonum maritimum* Linnaeus.

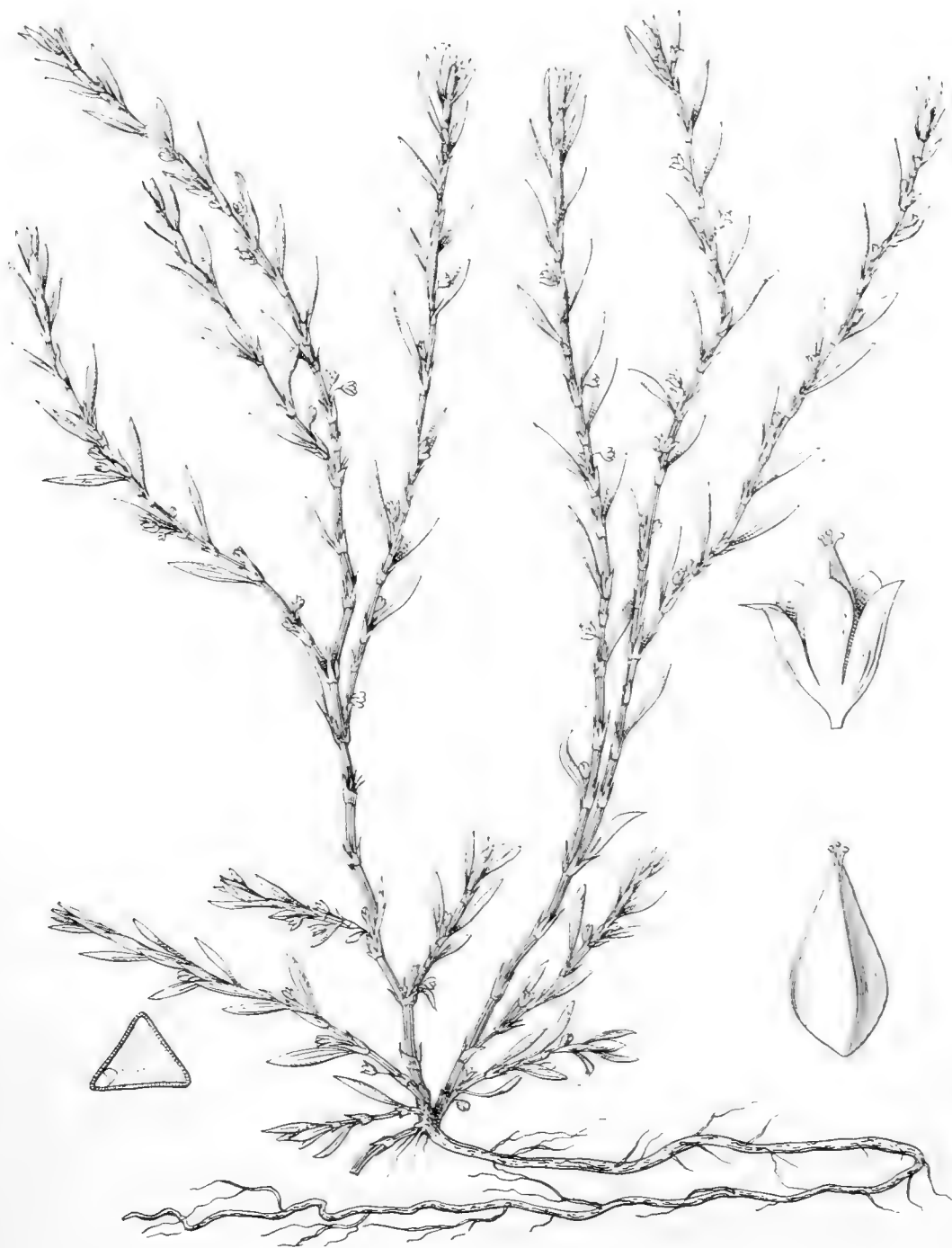
Polygonum maritimum Linnaeus, Sp. Pl. 361 (1753); Gmelin, Syst. Nat. 2: 639; Willdenow, Sp. Pl. 2: 449; Persoon, Syn. 1: 439; Muhlenberg, Cat. 40; Elliott, Bot. S. C. & Ga. 1: 453; Sprengel, Syst. 2: 256; Meisner, Monog. 89 and in DC. Prodr. 14: 88; Torrey, Fl. N. Y. 2: 152; Eaton & Wright, N. A. Bot. Ed. 8, 367; A. Gray, Man. 388; Darby, Bot. S. States, 488; Wood, Am. Bot. and Fl. 283.

Polygonum maritimum Pursh, Fl. Am. Sept. 269 (1814); Eaton, Man. 370; Elliott, Bot. S. C. & Ga. 1: 453.

Polygonum glaucum Nuttall, Gen. 1: 254 (1818); Torrey, Fl. 1: 401, Comp. 171; Sprengel, Syst. 2: 256; Beck, Bot. 300.

Perennial or sometimes annual, glaucous and glabrous throughout, somewhat fleshy. Stem prostrate, 2-7 dm. long, ridged, branched from the base and throughout, usually stout; leaves ovate, oblong or linear-oblong, .5-3 cm. long, .2-.8 cm. broad, generally equalling or exceeding the internodes of the stem and branches, rather fleshy, obtuse, revolute, acuminate at the base, strongly nerved especially beneath, somewhat rugose above, joined to the ocreae by conspicuous articulations, mostly sessile; ocreae funnelform, oblique, .3-1.5 cm. long, two-parted, at length lacerate, bright and silvery, becoming brown at the base; inflorescence axillary, consisting of clusters of two or three flowers; pedicels slender, 3-4 mm. long; calyx green about the base, 3 mm. long, five-parted to near the base, the segments obovate, petaloid, rather obtuse, white or pink with a green rib; stamens eight, included; style .4 mm. long, three-parted to the base, included except at maturity; achene triquetrous, 3.5-4 mm. long, ovoid, acute or acuminate, chestnut-colored, smooth and shining or minutely granular, conspicuously surpassing the calyx.

Along the seacoast from Maine to Georgia. Also on the coast of Europe.



POLYGONUM MARITIMUM LINNAEUS.



[PLATE 38.]

38. *Polygonum littorale* Link.

Polygonum littorale Link in Schrad. Journ. 1: 54 (1799); Persoon, Syn. 1: 439; Meisner in DC. Prodr. 14: 98.

Polygonum salsuginosum Wallroth, Linnaea, 14: 568 (1840).

Polygonum aviculare var. *littorale* Martens & Koch, Deutsche Fl. 3: 59 (1831).

Polygonum crassinerve Cesati, Stirp. Ital. fasc 2 (1840).

Annual or perennial, glabrous, bright green, often glaucous. Stem prostrate, 3–12 dm. long, diffusely branched from the woody base and throughout, conspicuously ridged, internodes often very short, especially at the ends or bases of branches, the whole plant sometimes dwarfed and reduced to a small, erect form less than 1 dm. long and simple or sparingly branched; leaves oblong, oblong-lanceolate or oblanceolate, .4–2 cm. long, .1–.6 cm. broad, usually obtuse or sometimes acutish, generally acuminate at the base, crowded or distant, conspicuously nerved, often crisped, short-petioled; petioles articulated at their junction with the ocreae; ocreae oblique, 4–5 mm. long, two-parted and silvery when young, at length lacerate and brownish; inflorescence axillary, consisting of clusters with from two to six flowers; calyx mostly green, five-parted to below the middle, the segments oblong, obtuse, with white borders or sometimes red; stamens eight, included; style .2 mm. long, three-parted to the base, included; achene triquetrous, 2–2.5 mm. long, broadly ovoid, usually somewhat constricted and often conspicuously so below the summit, enlarged and rounded at the base, dark brown, more or less granular, mostly dull, sometimes shining.

From New Brunswick to British Columbia southward to Virginia, Illinois, Kansas and California. Also in Europe.

***Polygonum littorale* Sitchense Small.**

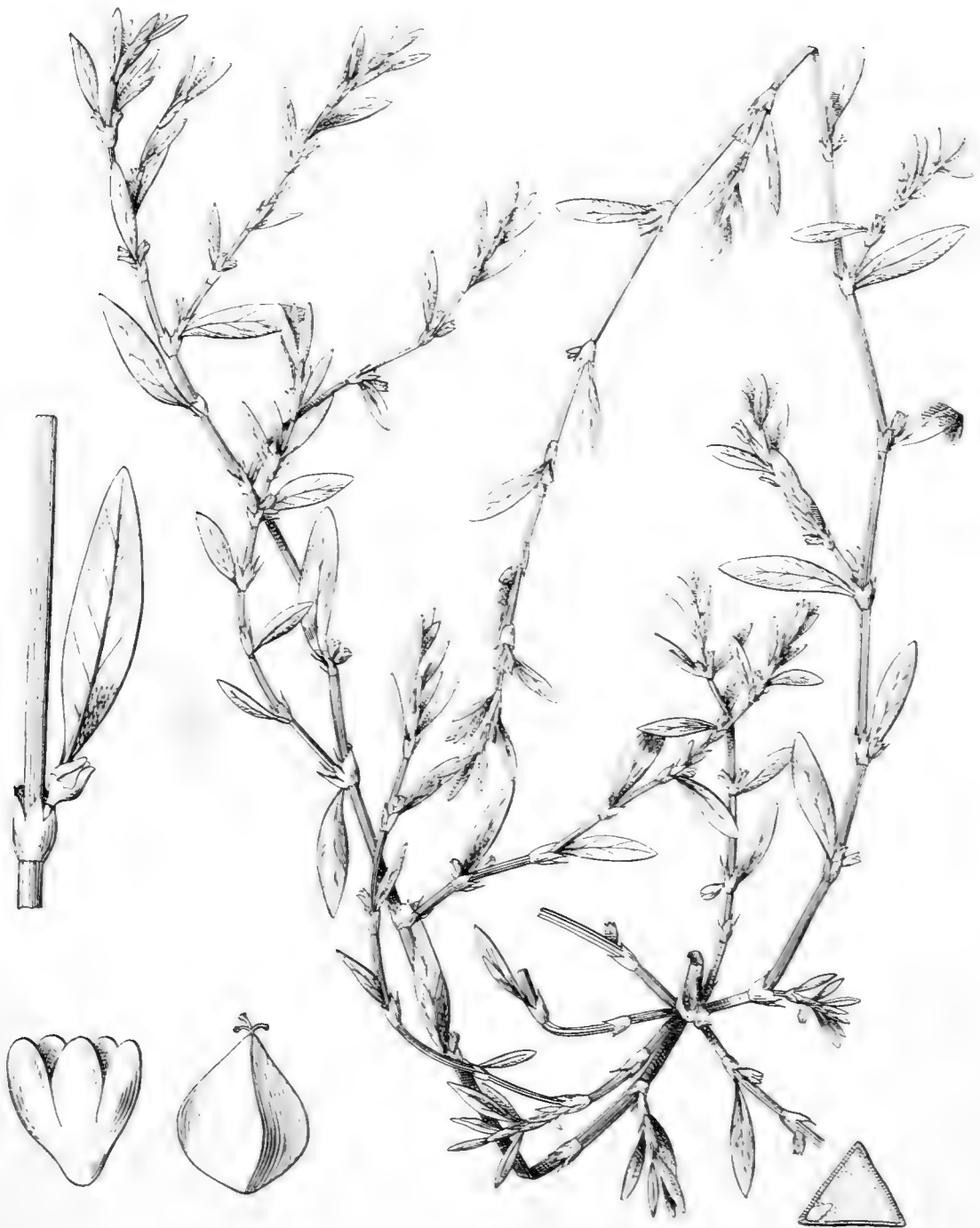
Polygonum aviculare var. *latifolium* Michaux, Fl. Bor. Am. 1: 237 (1803), according to Bongard, but doubtful.

Polygonum buxifolium Nuttall; Bongard, Veg. Ins. Sitcha, 161 (1831), not Bieb.

Polygonum aviculare var. *buxifolium* Ledebour, Fl. Ross. 3: 532 (1847–1849).

Stem stout; leaves linear-oblong, obtuse at the apex, attenuate at the base, subsessile, somewhat nerved; flowers one to two at a node; stamens five; achene triquetrous, somewhat exceeding the calyx, rather shining but somewhat granular.

Island of Sitcha.



POLYGONUM LITTORALE LINK.

[PLATE 39.]

39. *Polygonum aviculare* Linnaeus.

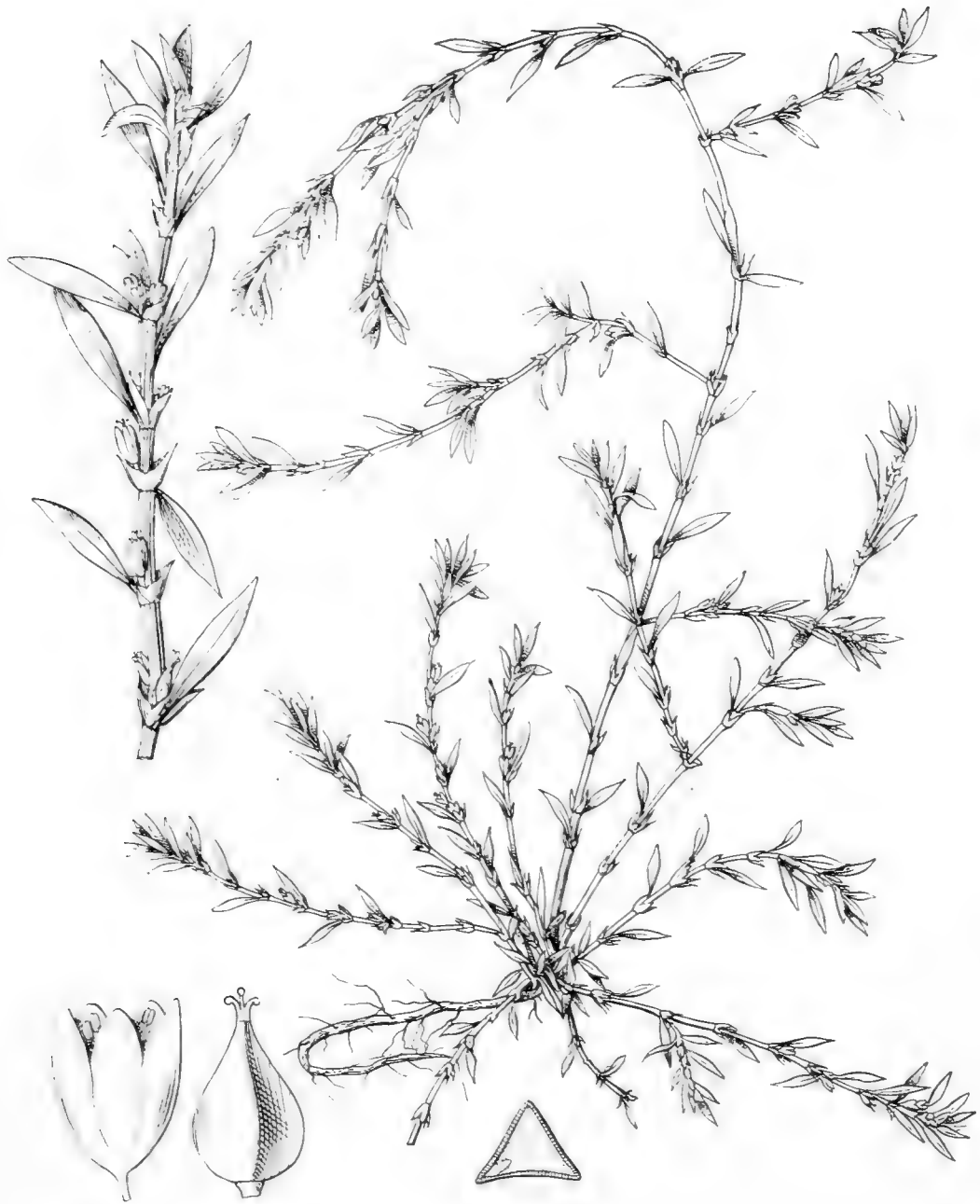
Polygonum aviculare Linnaeus, Sp. Pl. 362 (1753); Gmelin, Syst. Nat. **2**: 619; Walter, Fl. Car. 132; Willdenow, Sp. Pl. **2**: 449; Michaux, Fl. Bor. Am. **1**: 237; Persoon, Syn. **1**: 439; Muhlenberg, Cat. 40; Pursh, Fl. Am. Sept. 269; Bigelow, Fl. Bost. 93; Eaton, Man. 370; Nuttall, Gen. **1**: 254; Barton, Comp. Fl. Phil. 186; Elliott, Bot. S. C. and Ga. **1**: 453; Sprengel, Syst. **2**: 255; Torrey, Fl. **1**: 406, Comp. 171, Fl. N. Y. **2**: 152; Meisner, Monog. 87 and in DC. Prodr. **14**: 97; Darlington, Florula Cest. 48, Fl. Cest. 274; Hooker, Fl. Bor. Am. **2**: 132; Beck, Bot. 300; Eaton & Wright, N. A. Bot. Ed. 8, 367; A. Gray, Man. 388; Gay, Fl. Chil. **5**: 268; Wood, Cl. Bk. Ed. 41, 474, Am. Bot. and Fl. 283; Chapman, Fl. S. States, 390; Darby, Bot. S. States, 488; S. Watson, Bot. King's Exp. 315, Bot. Calif. **2**: 11; Behr, Fl. San Francisco, 275; Greene, Fl. Francis. 133.

Polygonum aviculare var. *angustifolium* Michaux, Fl. Bor. Am. **1**: 237 (1803); Nuttall, Gen. **1**: 254; Barton, Comp. Fl. Phil. 186.

Polygonum aviculare var. *procumbens* Meisner, Monog. 87 (1826); Torrey, Fl. N. Y. **2**: 152.

Annual or perennial, glabrous throughout, of a dull green or bluish-green color. Stem prostrate or ascending, 1–6 dm. long, from a woody base, simple or branched from below or throughout, striate or ridged; leaves oblong, linear-lanceolate or oblanceolate, .5–2 cm. long, .1–.5 cm. broad, usually acute or sometimes obtuse, joined to the petiole by an articulation near the base, acuminate at the base, crowded or distant, not conspicuously nerved, sub-sessile or short-petioled; ocreae oblique, 4 mm. long, silvery, two-cleft when young, becoming lacerate with age; inflorescence axillary, consisting of clusters with from two to five flowers; pedicels slender, 1–2 mm. long; calyx green, five-parted to below the middle, the segments oblong, obtuse, with white or pink borders; stamens varying from five to eight, included; style .3 mm. long, three-parted to below the middle, included; achene triquetrous, 2.5 mm. long, ovoid, acute, dark brown, rounded at the base, rather pointed at the apex, granular and dull.

Common throughout North America except the extreme north. Also in Europe and Asia.



POLYGONUM AVICULARE LINNAEUS.

[PLATE 40.]

40. Polygonum Bellardi Allioni.

Polygonum Bellardi Allioni, Fl. Pedem. **2**: 205. *t. 90. f. 2* (1785); Gmelin, Syst. Nat. **2**: 639; Persoon, Syn. **1**: 439; Meisner in DC. Prodr. **14**: 98.

Annual, glabrous, dingy-green or straw-colored. Stem erect or spreading and ascending, 2–9 dm. long, wiry, simple or much branched, ridged; leaves varying from oblong-lanceolate to linear-lanceolate, sometimes oblanceolate, .5–4 cm. long, .1–.9 cm. broad, acute, conspicuously nerved beneath, acuminate at the base, never crowded, short-petioled; petiole articulated at its junction with the ocrea; ocreae oblique, 5–7 mm. long, two-parted or slightly lacerate when young, becoming much lacerate and brown with age; inflorescence axillary, the clusters with two or three flowers; pedicels slender, about 3 mm. long; calyx green, 2 mm. long, five-parted to below the middle, the segments oblong, obtusish with a white border; stamens eight, included; style .1–.2 mm. long, three-parted to the base, included or somewhat exerted at maturity; achene triquetrous, 2–2.5 mm. long, varying from ovoid to oblong-ovoid, dark-brown, pointed at both ends, granular and rather dull.

In waste places, Washington, D. C. Adventive from western Asia or eastern Europe.



POLYGONUM BELLARDI ALLIONI

[PLATE 41.]

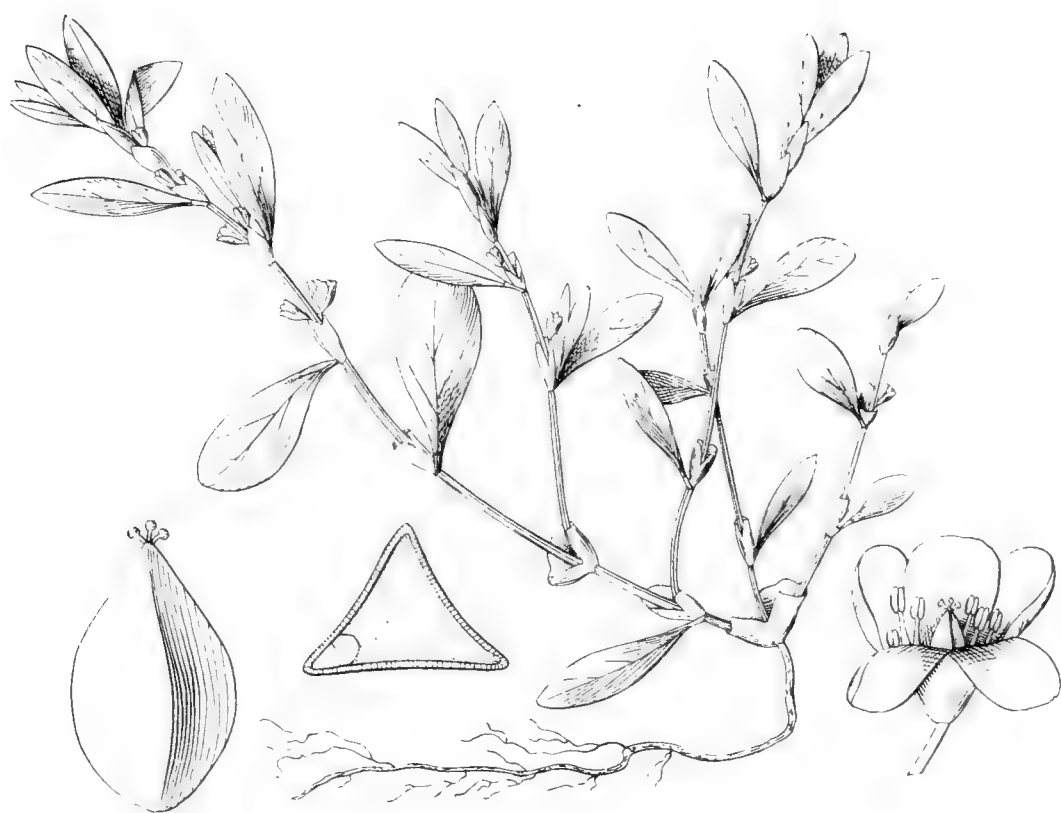
41. Polygonum Islandicum Meisner.

Polygonum aviculare var. *boreale* Lange, Consp. Fl. Groenl. 105 (1880), not *P. camporum* var. *boreale* Meisn. (1855).

Polygonum boreale Small, Bull. Torr. Club, **21** : 479 (1894).

Annual, stout, glabrous, herbaceous and somewhat fleshy. Stem ascending, 1–2 dm. long, simple or sparingly branched; leaves obovate or oblong, 1–3 cm. long, .5–1 cm. broad, obtuse, slightly papillose, somewhat acuminate at the base, midrib alone prominent, short-petioled; ocreae oblique, 5–7 mm. long, silvery or brownish, two-parted or slightly lacerate; inflorescence axillary, the clusters two-flowered; pedicels slender, 3–4 mm. long; calyx light green, 4 mm. long, five-parted to below the middle, inclined to be open, the segments obovate, obtuse, with white or cream-colored borders; stamens six, included, filaments short and stout; style .3–.4 mm. long, three-parted to the base, included; achene triquetrous, 3.5 mm. long, ovoid, usually somewhat pointed at both ends, granular and dull.

Greenland and Iceland.



POLYGONUM ISLANDICUM MEISNER.

[PLATE 42.]

42. *Polygonum erectum* Linnaeus.

Polygonum erectum Linnaeus, Sp. Pl. 363 (1753); Gmelin, Syst. 2: 639; Persoon, Syn. 1: 439; Willdenow, Sp. Pl. 2: 450; Muhlenberg, Cat. 40; Sprengel, Syst. 2: 256; Darlington, Florula Cest. 48, Fl. Cest. 248; Beck, Bot. 300; Eaton & Wright, N. A. Bot. Ed. 8, 367; Wood, Cl. Bk. Ed. 41, 474; Porter & Coulter, Syn. Fl. Colo. 123; Coulter, Man. Bot. Rocky Mt. Reg. 318.

Polygonum aviculare var. *latifolium* Michaux, Fl. Bor. Am. 1: 237 (1803); Nuttall, Gen. 1: 254; Barton, Comp. Fl. Phil. 186; Torrey, Fl. 1: 400; Wood, Cl. Bk. Ed. 41, 474.

Polygonum aviculare var. *erectum* Meisner, Monog. 88 (1826) and in DC. Prodr. 14: 97; Torrey, Fl. N. Y. 2: 152; A. Gray, Man. 388; Wood, Am. Bot. and Fl. 283.

Annual, stout, glabrous throughout, green when young, at length turning yellowish-green. Stem erect or ascending and somewhat spreading, 2-6 dm. long, nearly simple or much branched, becoming woody, conspicuously ridged; leaves oval, oblong or obovate, 1-6 cm. long, .5-2 cm. broad, mostly acuminate at the base, sessile or subsessile, sometimes short-petioled, obtuse or acutish, joined to the ocreae by a conspicuous articulation; ocreae funnelform, oblique, .3-1 cm. long, two-parted and silvery when young, becoming lacerate and brown with age; inflorescence axillary, consisting of clusters of several flowers; pedicels 2-2.5 mm. long; calyx greenish, 3 mm. long, five-parted to below the middle, the segments oblong, obtuse, paler or whitish on the margins; stamens six or sometimes five, included; style .1 mm. long, three-parted to below the middle, included; achene triquetrous, 3 mm. long, pyramidal-ovoid or broadly ovoid, dark-brown, granular and dull.

Ontario to the Northwest Territory south to Georgia, Texas and Colorado.



POLYGONUM ERECTUM LINNAEUS.

[PLATE 43.]

43. *Polygonum exsertum* Small.

Polygonum exsertum Small, Bull. Torr. Club, **21**: 172 (1894).

Annual or perennial by creeping rootstocks, slender, glabrous, sometimes glaucescent, of a light or dark brownish color. Stem erect, ascending or sometimes spreading, 4–9 dm. long, flexuous, rather conspicuously ridged, branched above or throughout, the branches slender and quite strict; leaves narrowly lanceolate or linear-lanceolate, or the lower sometimes obovate, 1–6 cm. long, .2–.7 cm. broad, acute or cuspidate, nearly sessile, acuminate at the base; ocreae funnelform, several-parted and silvery when young, soon becoming much lacerate and brownish especially at the base; inflorescence axillary, consisting of clusters of from two to four flowers; pedicels angled, 3–3.5 mm. long; calyx greenish, 3–3.5 mm. long, five-parted or sometimes six-parted to near the base, the segments narrowly oblong, obtuse, often with whitish or pink margins; stamens five or six, included; style less than .5 mm. long, three-parted usually to the base, exserted at maturity; achene triquetrous, 4–6 mm. long, narrowly pyramidal-ovoid, rounded at the base, inflated about the middle and somewhat constricted below the apex, chestnut-colored, smooth and shining, exceeding the calyx by one-third or two-thirds of its length when mature and slightly spirally twisted.

Northwest Territory to Nebraska, Missouri and Illinois; also from Maine to New Jersey.



POLYGONUM EXSERTUM SMALL.

[PLATE 44.]

44. *Polygonum ramosissimum* Michaux.

Polygonum ramosissimum Michaux, Fl. Bor. Am. **1**: 237 (1803); Willdenow, Sp. Pl. **2**: 450; Persoon, Syn. **1**: 439; Pursh, Fl. Am. Sept. 269; Muhlenberg, Cat. 41; Eaton, Man. 370; Sprengel, Syst. **2**: 260; Meisner, Monog. 91 and in DC. Prodr. **14**: 97; A. Gray, Man. 388; Wood, Am. Bot. and Fl. 283; Coulter, Man. Bot. Rocky Mt. Reg. 319; Greene, Fl. Francis. 134.

Polygonum ariculare var. *erectum* S. Watson, Bot. King's Exp. 315 (1871), not Meisner.

Polygonum erectum S. Watson, Bot. Calif. **2**: 11 (1880), not Linnaeus.

Annual, glabrous, somewhat scurfy, more or less suffruticose, of a bright green or yellowish green color, woody. Stem erect or ascending, 1–3 dm. long, somewhat virgate, nearly simple or diffusely branched, conspicuously ridged; branches ascending or spreading; leaves lanceolate, oblong or linear-oblong, .7–4 cm. long, .1–.8 cm. broad, acuminate at both ends or acute at apex, short-petioled, persistent, joined to the ocreae by conspicuous articulations, nerves either prominent or indistinct on the lower surface; ocreae funnelform, oblique, .5–1.5 cm. long, two-parted when young, very early becoming lacerate, silvery, at length turning brown; inflorescence axillary, the clusters several-flowered; pedicels 1.5–2 mm. long; calyx greenish or yellowish, about 3 mm. long, five-parted or six-parted to near the base, the segments narrowly oblong; stamens six or fewer, sometimes only three, included; style .1 mm. long, three-parted to the base, included; achene triquetrous, 3 mm. long, ovoid, pointed, mostly included or rarely slightly protruding beyond the calyx, black, somewhat granular and not shining.

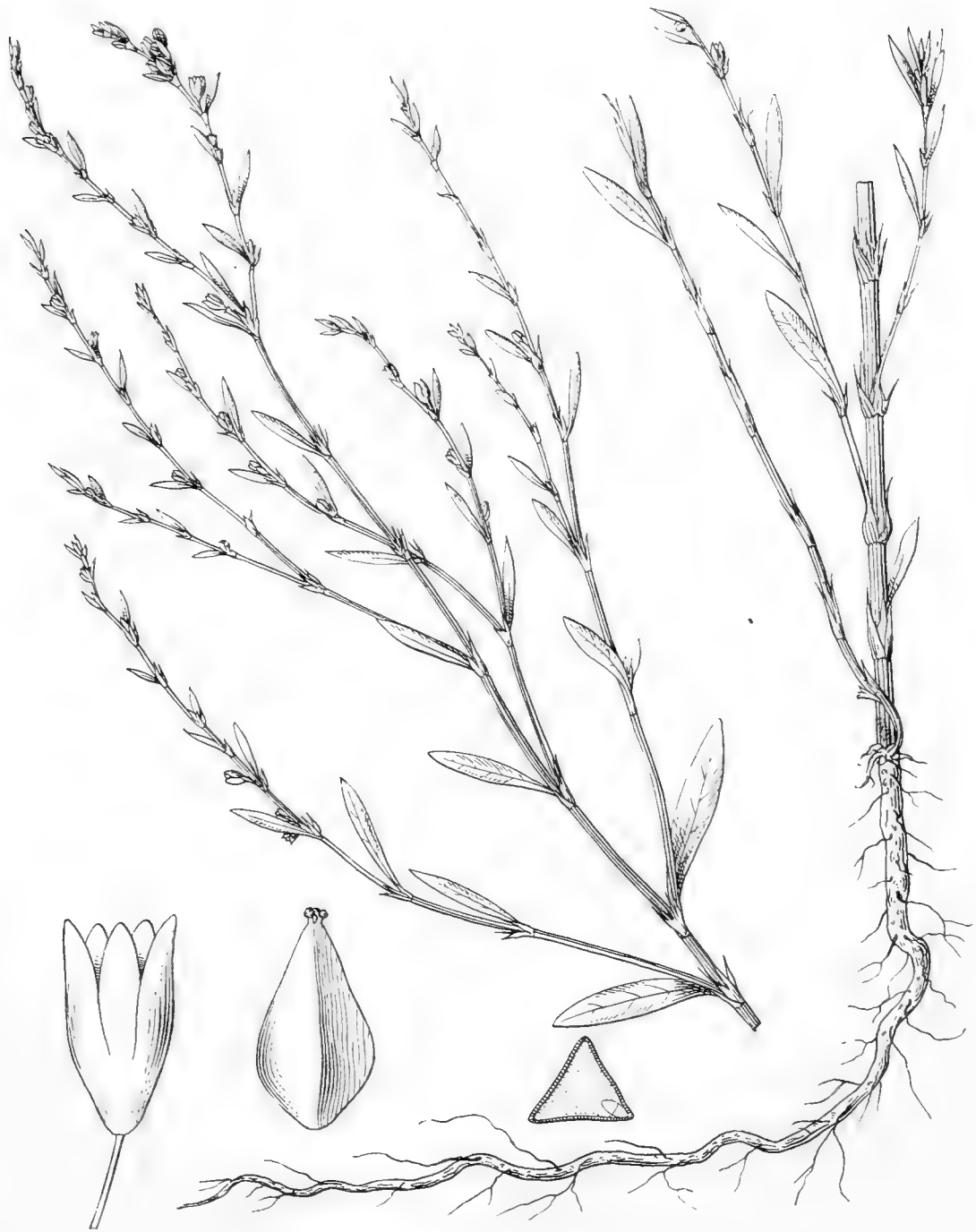
From the Northwest Territory south to California, New Mexico, Texas and Illinois; also along the Atlantic Coast from Maine to New Jersey.

***Polygonum ramosissimum prolificum* Small.**

Polygonum ramosissimum prolificum Small, Bull. Torr. Club, **21**: 171 (1894).

Conspicuously bushy and much branched; stem erect or nearly so, 6–10 dm. long, rather stout and woody, internodes short, 1–3 cm. long; nodes proliferous, producing two or more branches; leaves variable in size and narrower than those of the species; flowers and achenes more numerous than in the normal form.

Nebraska and Kansas; also on the coast of Maine.



POLYGONUM RAMOSISSIMUM MICHAUX.

[PLATE 45.]

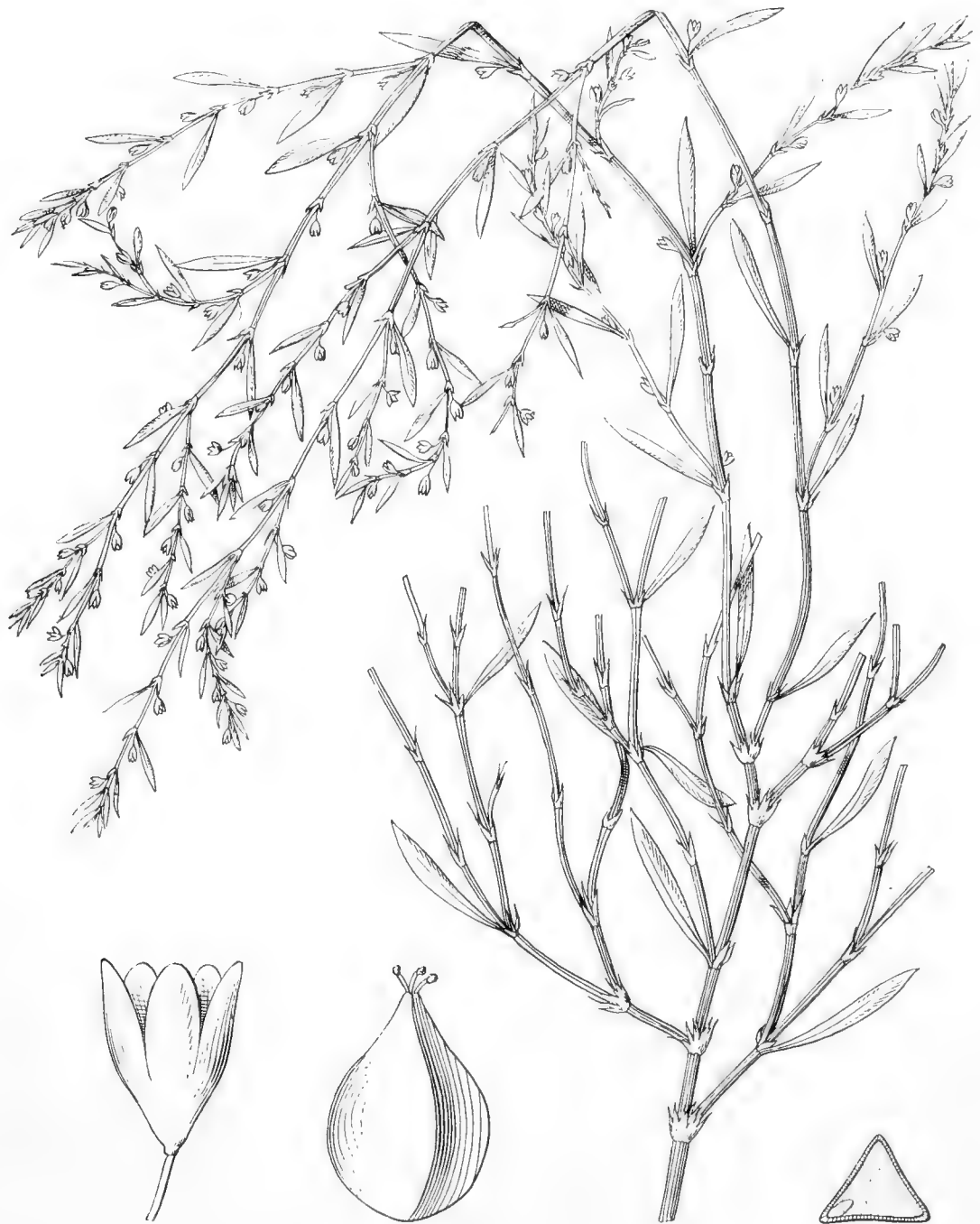
45. *Polygonum camporum* Meisner.

Polygonum camporum Meisner in Mart. Fl. Bras. 5: 21 (1855) and in DC. Prodr. 14: 87.

Polygonum camporum var. *boreale* Meisner in Mart. Fl. Bras. 5: 22 (1855) and in DC. Prodr. 14: 87; Torrey, Bot. Mex. Bound. Surv. 178; A. Gray, Man. Ed. 6, 440.

Perennial or sometimes annual, slender, suffruticose, glabrous, rarely glaucescent, turning brown or black in drying. Stem erect, ascending or creeping at the base, 6–10 dm. long, nearly terete or more or less ridged, nearly simple or much branched and straggling; leaves varying from linear-lanceolate to oblong, 1–3 cm. long, .1–.5 cm. broad, sometimes oblanceolate, obtuse or acute, sessile, fugacious or rarely somewhat persistent, conspicuously nerved on the lower surface, flat or revolute; ocreae funnelform, 3–5 mm. long, oblique and two-parted when very young, silvery, at length dark brown, soon becoming much lacerate and falling away; inflorescence axillary, the clusters several-flowered; pedicels slender, 2–3 mm. long; calyx greenish, 3 mm. long, five-parted to near the base, the segments oblong; stamens eight, included; style .4 mm. long, three-parted to the base, included; achene triquetrous, 3 mm. long, broadly ovoid, black or dark-brown, smooth and shining.

Nebraska to Louisiana and New Mexico. Also in South America.



POLYGONUM CAMPORUM MEISNER.

[PLATE 46.]

46. *Polygonum Douglasii* Greene.

Polygonum tenue Engelmänn; A. Gray, Proc. Acad. Phila. 75 (1863), not Michaux; S. Watson, Bot. King's Exp. 315, Bot. Calif. 2: 12; Coulter, Man. Bot. Rocky Mt. Reg. 319.

Polygonum tenue var. *commune* Engelmänn; A. Gray, Proc. Acad. Phila. 75 (1863).

Polygonum Douglasii Greene, Bull. Calif. Acad. Sci. 1: 125 (1884), Fl. Francis. 134.

Annual, slender, glabrous except the more or less scabrous nodes, sometimes glaucescent. Stem erect, 2–4 dm. long, nearly simple or branched from the base or throughout, lax or strict, almost terete or somewhat ridged; leaves oblong or narrowly lanceolate, 1–5 cm. long, .2–.8 cm. broad, obtuse, acute or cuspidate, subsessile or sessile, acuminate at the base, rather thin, flat, or somewhat revolute, with no lateral impressions, joined to the ocreae by conspicuous articulations; ocreae funnelform, oblique, 10–14 mm. long, two-parted, at length lacerate; inflorescence axillary, the clusters several-flowered or occasionally only a single flower at a node; pedicels 2–3 mm. long, reflexed and at length deflexed; calyx greenish, 3–4 mm. long, drooping, five-parted to near the base, the segments oblong, obtuse, with whitish or rose-colored margins and a dark rib in the middle; stamens eight, included; style .3 mm. long, three-parted to near the base, the segments somewhat divergent and slightly protruding beyond the calyx at maturity; achene triquetrous, 3–4 mm. long, oblong or rarely ovoid-oblong, black, smooth and shining.

Northwest Territory to California, New Mexico and Indian Territory, east to Ontario, Vermont and New York.

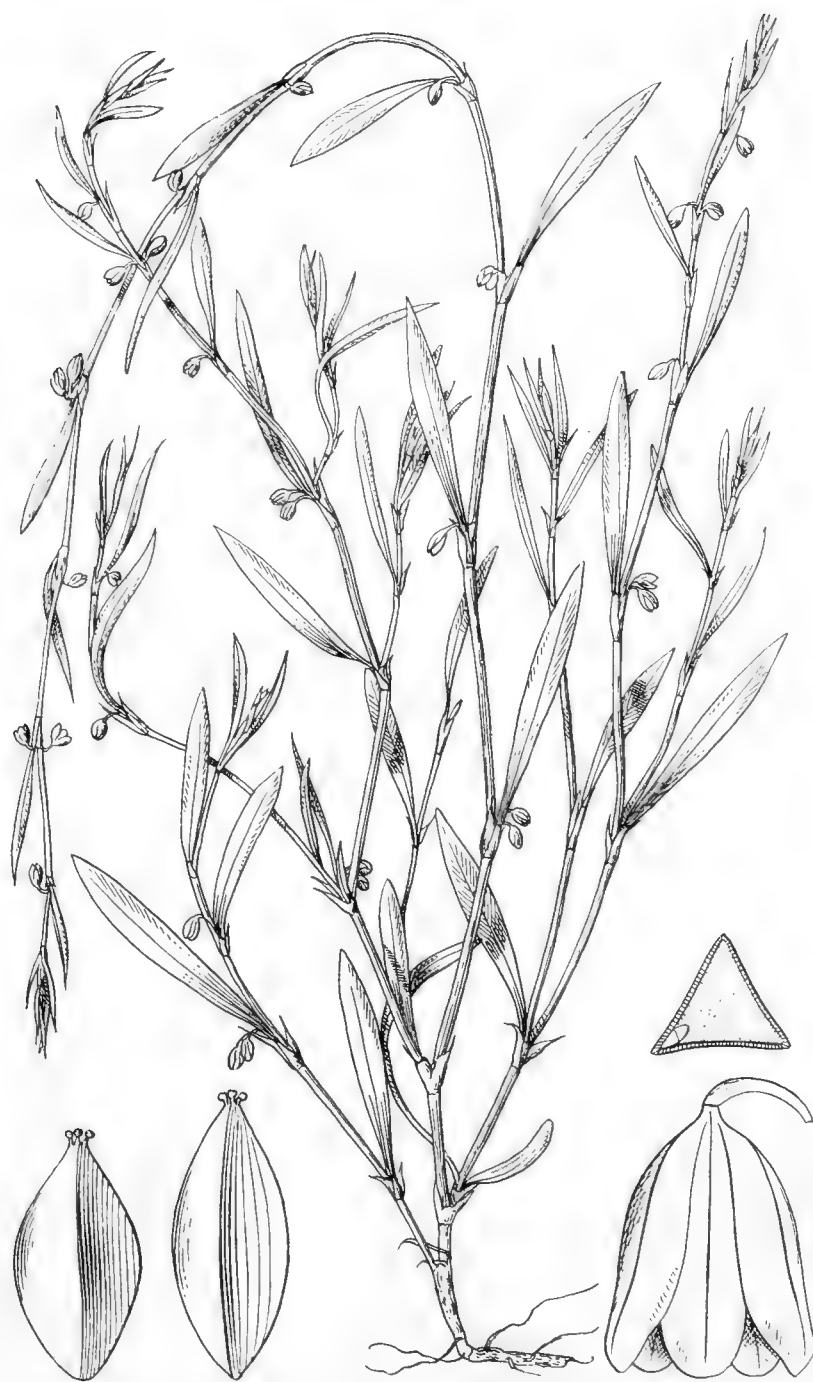
***Polygonum Douglasii montanum* Small.**

Polygonum tenue var. *latifolium* Engelmänn, Proc. Acad. Phila. 75 (1863), not *P. aviculare* var. *latifolium* Michx. (1803); S. Watson, Bot. King's Exp. 315; Coulter, Man. Bot. Rocky Mt. Reg. 319.

Polygonum Douglasii var. *latifolium* Greene, Bull. Calif. Acad. Sci. 1: 125 (1884), Fl. Francis. 134.

Stout, more or less fleshy, glaucescent; stem erect, .5–2.5 dm. long or sometimes prostrate, simple or sparingly branched from near the base; leaves oblong or oblanceolate, 1–4.5 mm. long, 2–12 mm. broad, apiculate, sessile; inflorescence mostly towards the ends of the branches; achene triquetrous, 3 mm. long, oblong, black, smooth and shining.

Arizona to California and northward in the higher mountains.



POLYGONUM DOUGLASII GREENE.

[PLATE 47.]

47. *Polygonum Sawatchense* Small.

Polygonum Sawatchense Small, Bull. Torr. Club, **20**: 213 (1893).

Annual, usually slender, glabrous, more or less scurfy or papillose throughout, of a dull green color. Stem erect, .5–2 dm. long, nearly simple or branched from or near the base, minutely ridged, obscurely four-angled and four-winged below the ocreae; leaves oblanceolate, narrowly obovate, or almost linear near the ends of the branches, .5–2 cm. long, 1–6 mm. broad, acute, sessile, acuminate at the base, flat or revolute, often much the same length even to the ends of the stems, joined to the ocreae by conspicuous articulations, midrib prominent on the lower surface and often wing-like; ocreae funnelform, oblique, 4–6 mm. long, two-parted, at length lacerate to the middle; inflorescence axillary, consisting of clusters with from two to four flowers and extending to the base of the plant; pedicels 2 mm. long; calyx green, 2–3 mm. long, five-parted to near the base or to below the middle, the segments oblong, obtuse, only slightly lighter-colored on the margins; stamens 6–8; style almost wanting, stigma three-cleft, included; achene triquetrous, 2.5–2.8 mm. long, oblong, rather obtuse at both ends or sometimes acute at the apex, black, very smooth and shining.

Dakota to Washington south to Colorado.



POLYGONUM SAWATCHENSE SMALL.

[PLATE 48.]

48. *Polygonum tenue* Michaux.

Polygonum tenue Michaux, Fl. Bor. Am. 1: 238 (1803); Persoon, Syn. 1: 439; Pursh, Fl. Am. Sept. 270; Eaton, Man. 370; Elliott, Fl. S. C. and Ga. 1: 454; Sprengel, Syst. 2: 256; Torrey, Fl. 1: 401, Comp. 171; Meisner, Monog. 91 and in DC. Prodr. 14: 100; Darlington, Florula Cest. 48, Fl. Cest. 248; Hooker, Fl. Bor. Am. 2: 132; Beck, Bot. 301; Bigelow, Fl. Bost. 155; Eaton & Wright, N. A. Bot. Ed. 8, 367; A. Gray, Man. 389; Wood, Cl. Bk. Ed. 41, 474, Am. Bot. and Fl. 283; Chapman, Fl. S. States, 390; Darby, Bot. S. States, 488; Greene, Bull. Cal. Acad. Sci. 1: 125; Coulter, Man. Bot. Rocky Mt. Reg. 319.

Polygonum linifolium Muhlenberg, Cat. 40 (1813); Barton, Comp. Fl. Phil. 1: 186; Wood, Cl. Bk. Ed. 41, 474.

Polygonum filiformis Barton, Comp. Fl. Phil. 1: 186 (1818), not Thunb.

Polygonum tenue var. *commune* Engelman; A. Gray, Proc. Acad. Phila. 75 (1863).

Annual, slender, glabrous throughout or somewhat scabrous and scurfy about the nodes. Stem erect, 1–3 dm. long, simple or much branched, more or less four-angled or four-winged below the ocreae; leaves linear or linear-lanceolate, .5–3 cm. long, .1–.3 cm. broad, acuminate or cuspidate, sessile, with two lateral impressions appearing as ribs parallel to the midrib, articulated to the ocreae, minutely scabrous on the margin, more or less scurfy on the lower surface, sometimes revolute; ocreae funnelform, oblique, 3–15 mm. long, two-parted, at length lacerate; inflorescence axillary, consisting of clusters bearing several flowers or sometimes only one flower at a node; pedicels stout, 1–1.5 mm. long; calyx green, 3 mm. long, erect, five-parted to near the base, the segments ovate, acutish, with whitish margins; stamens eight, included; style .3–.4 mm. long, three-parted to near the base, the segments diverging, included or protruding slightly beyond the calyx; achene triquetrous, 3 mm. long, ovoid, pointed, black, granular about the angles, the centres of the faces smooth and shining.

Canada to Minnesota south to Georgia and New Mexico.



POLYGONUM TENUE MICHAUX.

[PLATE 49.]

49. *Polygonum Engelmanni* Greene.

Polygonum tenue var. *microspermum* Engelmann in A. Gray, Proc. Amer. Acad. 1863, 75 (1863); Coulter, Man. Bot. Rocky Mt. Reg. 319, not *P. microspermum* Jord.

Polygonum Engelmanni Greene, Bull. Calif. Acad. Sci. **1**: 126 (1884).

Polygonum microspermum Small, Bull. Torr. Club, **19**: 366 (1892).

Annual, very slender, glabrous, scurfy, rather wiry. Stem often diffusely branched at the base, the branches erect-spreading, .5–2 dm. long, nearly simple or diffusely branched from below, reddish, four-angled or somewhat winged, usually floriferous throughout; leaves varying from linear-lanceolate to linear-oblong, .2–1.5 cm. long, 1–2 mm. broad, light green or glaucous beneath, acute, sessile, articulated to the ocreae, the uppermost reduced to bracts; ocreae funnelform, 3–4 mm. long, at length slightly lacerate, rather inconspicuous; inflorescence axillary, consisting of clusters with from two to four flowers, and extending from the base to the ends of the branches; pedicels reflexed and at length deflexed, 1 mm. long; calyx dark green, 2–2.5 mm. long, drooping, five-parted to near the base, the segments oblong, obtuse, with whitish borders; stamens varying from five to eight, included; style .4 mm. long, three-parted to near the base, at length somewhat exserted; achene triquetrous, 2–2.6 mm. long, ovoid or oblong, black, smooth and shining, sometimes slightly exceeding the calyx at maturity.

High mountains of Colorado.



POLYGONUM ENGELMANNI GREENE.

[PLATE 50.]

50. *Polygonum Austinae* Greene.

Polygonum Austinae Greene, Bull. Calif. Acad. Sci. **2**: 212 (1885).

Annual, low, glabrous, scurfy throughout. Stem mostly erect, .5–1.7 cm. long, branched from the base, sparingly branched above, four-angled and somewhat four-winged, scurfy especially below the nodes; leaves varying from ovate-lanceolate to oblanceolate, .5–1.5 cm. long, .2–.5 cm. broad, the upper ones reduced to bracts, acute, sessile, revolute or flat, bright green beneath, midrib prominent on the lower surface, articulations at the ocreae not conspicuous; ocreae funnelform, 3–4 mm. long, oblique and at length slightly lacerate; inflorescence axillary, consisting of clusters with two or three flowers, extending from near the base of the plant to the ends of the branches; pedicels 1–1.5 long, mostly deflexed; calyx green, 2.5 mm. long, drooping, five-parted to near the base, the segments narrowly oblong, obtuse, with whitish borders and a dark rib; stamens varying from five to eight, included; style about .5 mm. long, three-parted to the base; achene triquetrous, 2.5–3 mm. long, ovoid or oblong, black, smooth and shining, somewhat exceeding the calyx at maturity.

Northwest Territory to northern California and Wyoming.



POLYGONUM AUSTINAE GREENE.

[PLATE 51.]

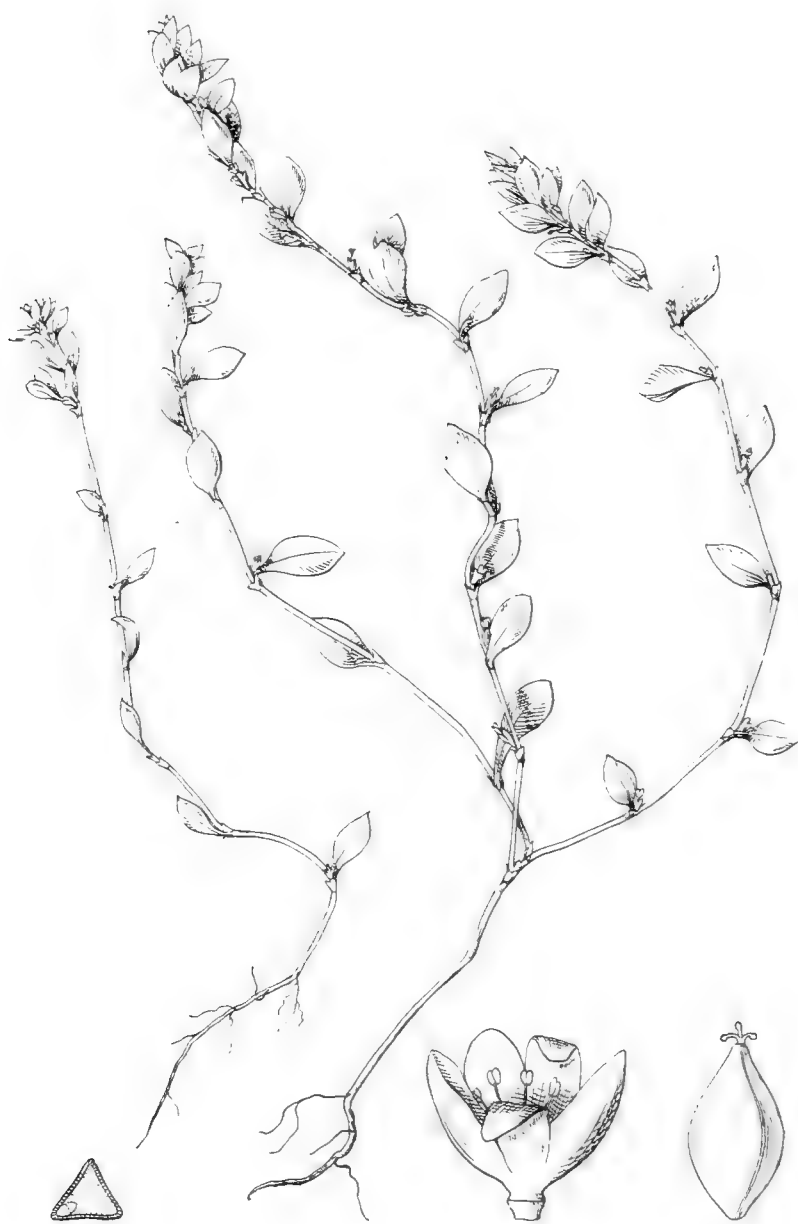
51. *Polygonum minimum* S. Watson.

Polygonum minimum S. Watson, Bot. King's Exp. 315 (1871), Bot. Calif. **2**: 11; Coulter, Man. Bot. Rocky Mt. Reg. 318; Greene, Fl. Francis. 133.

Polygonum Torreyi S. Watson, Am. Nat. **7**: 664 (1873), Bot. Calif. **2**: 12.

Annual, small and slender, somewhat scurfy but glabrous. Stem erect or spreading, .3–3 dm. long, wiry, simple or branched mostly from the base, somewhat angled; leaves mostly obovate, sometimes oblong or ovate, .5–1.8 cm. long, .2–.7 cm. broad, acute or apiculate, subsessile, acuminate at the base, more or less glaucescent, evenly distributed or crowded at the ends of the branches, not much reduced above, joined to the ocreae by conspicuous articulations; ocreae funnelform, oblique, 1–4 mm. long, brittle, dentate-lacerate; inflorescence axillary, consisting of clusters bearing several flowers and extending throughout the plant; pedicels slender, 2–3 mm. long; calyx greenish, 1.5–2 mm. long, five-parted to near the base, the segments paler and often with rose-colored margins; stamens varying from five to eight, included; style .2 mm. long, three-parted to below the middle, included; achene triquetrous, 2–2.3 mm. long, varying from oblong to oblong-ovoid, black, smooth and shining, at maturity somewhat protruding beyond the calyx.

Northwest Territory to California and Utah.



POLYGONUM MINIMUM S. WATSON.

[PLATE 52.]

52. *Polygonum spergulariaeforme* Meisner.

Polygonum coarctatum Douglas; Hooker, Fl. Bor. Am. **2**: 133 (1834), not Willd.; Meisner in DC. Prodr. **14**: 101; S. Watson, Bot. King's Exp. 316, Bot. Calif. **2**: 12.

Polygonum spergulariaeforme Meisner; Small, Bull. Torr. Club, **19**: 366 (1892).

Annual, scurfy throughout but especially about the nodes, glabrous, rather slender and wiry. Stem mostly erect, 1–5 dm. long, nearly simple and rather strict or corymbosely-branched and sometimes diffuse, more or less angled; leaves linear-oblong or linear-lanceolate, sometimes oblanceolate, .4–3 cm. long, 1–7 mm. broad, occasionally almost linear, acute, sessile, usually revolute, conspicuously articulated to the ocreae; ocreae funnelform, .5–1 cm. long, two-parted when young, at length lacerate; inflorescence axillary, consisting of clusters with several flowers, confined mostly to the ends of the branches and appearing as terminal racemes by the shortening of the internodes; pedicels about 1.5 mm. long; calyx whitish or pink, 4 mm. long, five-parted to near the base, the segments obovate, obtuse, each with a dark green nerve; stamens eight, included, the filaments hardly dilated at the base; style .5–.8 mm. long, three-parted to the middle or sometimes to near the base, included; achene triquetrous, 3.5–4 mm. long, oblong, black, smooth and shining except the more or less granular apex and angles.

Northwest Territory and British Columbia to California and Colorado.



POLYGONUM SPARGULARIAEFORME MEISNER.



[PLATE 53.]

53. Polygonum Nuttallii Small.

Polygonum intermedium Nuttall; S. Wats. Proc. Am. Acad. **17**: 378 (1882), not Ehrh.

Annual, slender, wiry, glabrous throughout. Stem erect, .3–3 cm. long, simple or irregularly and divergently branched, dark red, four-angled and slightly winged especially above; leaves varying from linear-lanceolate to linear-oblong, .8–3 cm. long, .2–.3 cm. broad, acute, sessile, glaucescent beneath, more or less revolute, articulated to the ocreae; ocreae funnelform, 3–4 mm. long, oblique, at length lacerate; inflorescence axillary, consisting of several-flowered clusters, mostly confined to the ends of the branches and appearing as terminal racemes by the shortening of the internodes; pedicels 1.5–2 mm. long, slender, reddish; calyx greenish, 2.5 mm. long, five-parted to near the base, the segments oblong with pinkish margins; stamens eight, sometimes fewer, included, the filaments conspicuously dilated at the base; style .3 mm. long, included, three-parted to the base; achene triquetrous, 2–2.3 mm. long, ovoid or sometimes ovoid-oblong, slightly constricted near the apex, black, smooth and shining.

British Columbia to Oregon.



POLYGONUM NUTTALLII SMALL.

[PLATE 54.]

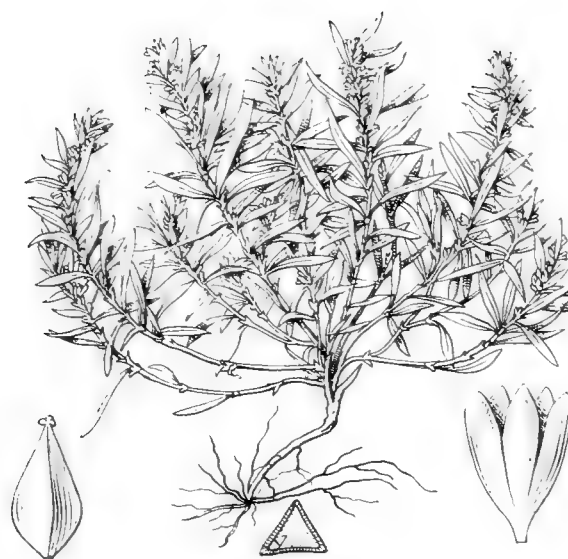
54. *Polygonum Kelloggii* Greene.

Polygonum Kelloggii Greene, Fl. Francis. 134 (1891).

Polygonum coarctatum var. *minus* Meisner in DC. Prodr. 14: 101 (1856), not *P. minus* Huds.; S. Watson, Bot. King's Exp. 316.

Annual, low, slender, glabrous throughout, somewhat scurfy. Stem mostly erect, 1–5 cm. long, divergently branched from near the base, more or less four-angled, in some cases slightly winged, internodes of the branches very short; leaves linear or linear-lanceolate, .4–1 cm. long, 1–2 mm. broad, acute, sessile, crowded on the branches but spreading and not imbricated, much the same size throughout, joined to the ocreae by inconspicuous articulations; ocreae funnelform, 1–2 mm. long, oblique, thin and early lacerate; inflorescence axillary, consisting of clusters with several flowers, almost contiguous on account of the very short internodes, the branches appearing like leafy racemes; pedicels .5 mm. long; calyx green, nearly 2 mm. long, five-parted to near the base, the segments oblong, obtuse, with whitish or cream-colored margins; stamens about five, included; style often almost wanting; achene triquetrous, 1.5 mm. long, rhombic-ovoid, light-brown, granular, somewhat striate, dull.

Washington south to California and Colorado.



POLYGONUM KELLOGGII GREENE.



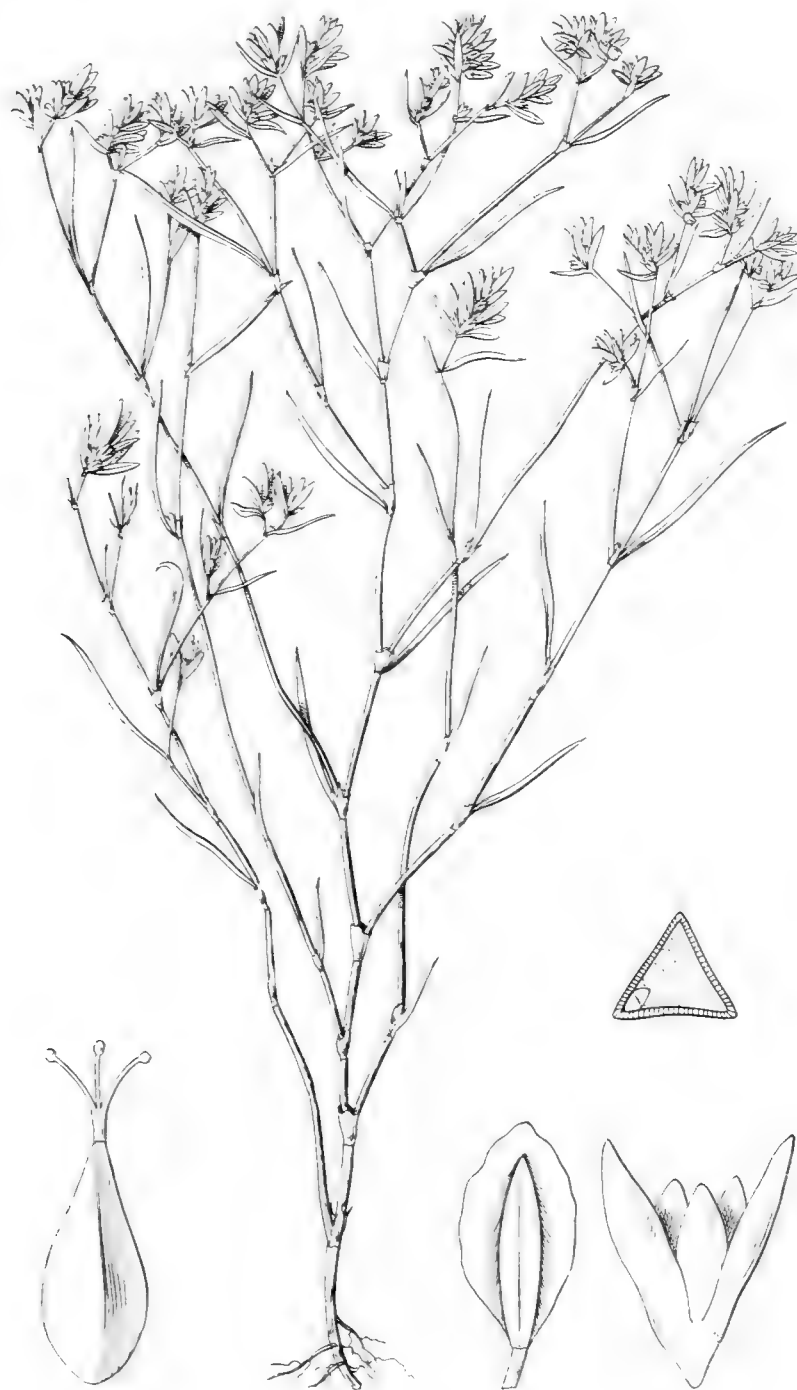
[PLATE 55.]

55. *Polygonum polygaloides* Meisner.

Polygonum polygaloides Meisner in DC. Prodr. **14**: 101 (1856); S. Watson, Bot. Calif. **2**: 12.

Annual, slender, glabrous, light green or straw-colored. Stem erect, 1-2 dm. long, simple or more or less corymbosely branched, slightly flexuous, obscurely four-angled; leaves linear or narrowly linear, .5-3 cm. long, .1-2 mm. broad, acute, rather strict, articulated to the ocreae; ocreae funnelform, 3-5 mm. long, oblique, at first two-parted, soon lacerate; inflorescence axillary, the clusters several-flowered, confined to the ends of the branches, nearly contiguous and forming a terminal raceme; bracts usually oblong, obtuse, surrounded with scarious wings, more or less imbricated; pedicels 2-2.5 mm. long; calyx 2 mm. long, five-parted to near the base, white or pinkish, the segments lanceolate with a dark rib, the outer ones longer than the inner; stamens eight, included; style three-parted to below the middle, included; achene triquetrous, ovoid, 1-1.5 mm. long.

Washington and Oregon to Montana.



POLYGONUM POLYGALOIDES MEISNER.

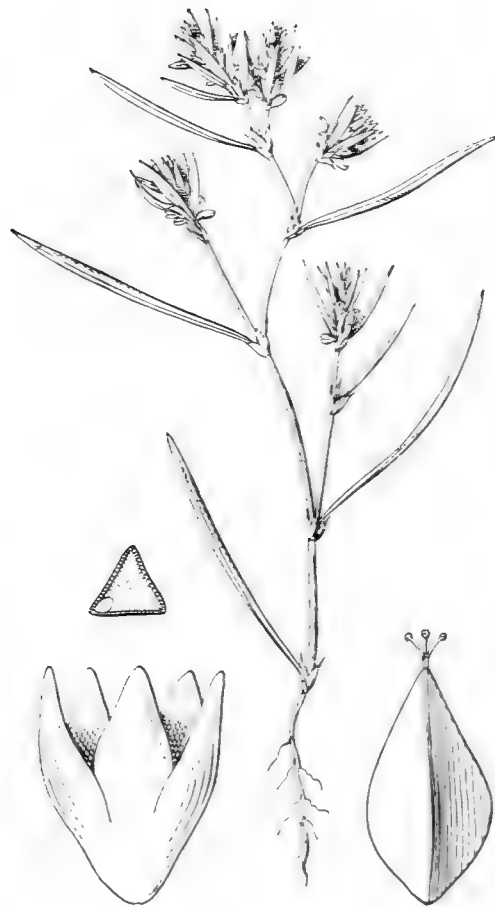
[PLATE 56.]

56. *Polygonum Watsoni* Small.

Polygonum imbricatum Nuttall; S. Watson, Am. Nat. **7**: 665 (1873), not Raf., Bot. Calif. **2**: 12; Porter, Bot. Wheeler Exp. 232; Porter & Coulter, Syn. Fl. Colo. 123; Coulter, Man. Bot. Rocky Mt. Reg. 319; Greene, Fl. Francis. 315.

Annual, low, slender, glabrous and smooth except a slight scurfy roughening about the nodes. Stem erect, .5–1.5 dm. long, simple or sparingly branched, four-angled; leaves linear, 1–5 cm. long, acute, divergent, those near the ends of the branches reduced to linear-lanceolate bracts, .4–1 cm. long, acute, crowded and imbricated, conspicuously articulated to the ocreae; ocreae funnelform, 2–4 mm. long, silvery, two-parted but early lacerate; inflorescence axillary, consisting of clusters bearing several flowers, confined to the ends of the branches, appearing as terminal racemes; pedicels about 1 mm. long; calyx green, 2 mm. long, five-parted to below the middle, the segments ovate, obtusish, often somewhat colored on the margins, the outer ones not longer than the inner; stamens five or fewer, included; style .2–.3 mm. long, three-parted to below the middle, included; achene triquetrous, 1.5 mm. long, narrowly-ovoid, nearly black, prominently granular in ridges.

Washington to Montana south to California and Colorado.



POLYGONUM WATSONI SMALL.

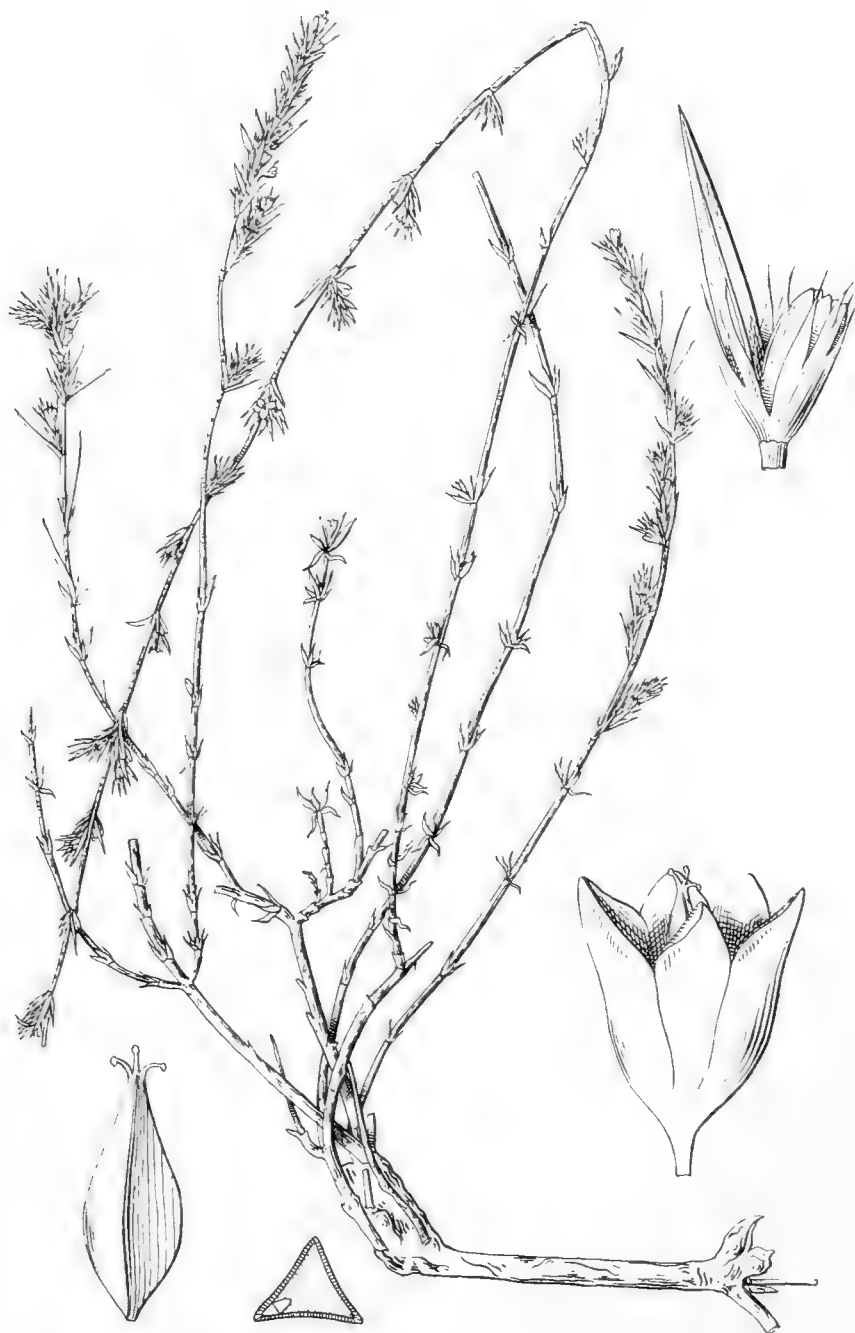
[PLATE 57.]

57. *Polygonum Bolanderi* Brewer.

Polygonum Bolanderi Brewer; A. Gray, Proc. Am. Acad. 8: 400 (1872); S. Watson, Bot. Calif. 2: 11; Greene, Fl. Francis. 133, Man. Bay Reg. Bot. 40.

Perennial by a woody root, wiry, glabrous, suffrutescent below and somewhat woody throughout. Stem often quite stout, clothed with a scaly bark, branched from the base, the branches few or numerous, erect, 2–6 dm. long, nearly simple, wiry, with a dark red shining bark and mostly naked for about half their length; leaves linear or almost subulate, reduced to bracts on the ultimate divisions of the branches, .3–1.5 cm. long, generally less than 1 mm. broad, acute or cuspidate, with a prominent midrib and two partially developed ribs along the margins, not articulated to the ocreae; ocreae funnelform, 5–10 mm. long, conspicuous and imbricated on the branchlets, finely lacerate; inflorescence consisting of short axillary and terminal spikes; spikes stout, 1–2 cm. long, covered by the imbricated ocreae, bearing one flower at each node; calyx sessile, 2–3.5 mm. long, mostly hidden in the ocreae, five-parted to below the middle, each segment whitish or rose-colored with a dark green rib; stamens eight or sometimes nine, included; style .4 mm. long, three-parted, apparently formed by the splitting of the apex of the ovary or achene; achene triquetrous, 2.5 mm. long, oblong-ovoid, dark chestnut-colored, smooth and shining.

Vicinity of Napa and about the eastern base of the Napa mountains, California.



POLYGONUM BOLANDERI BREWER.

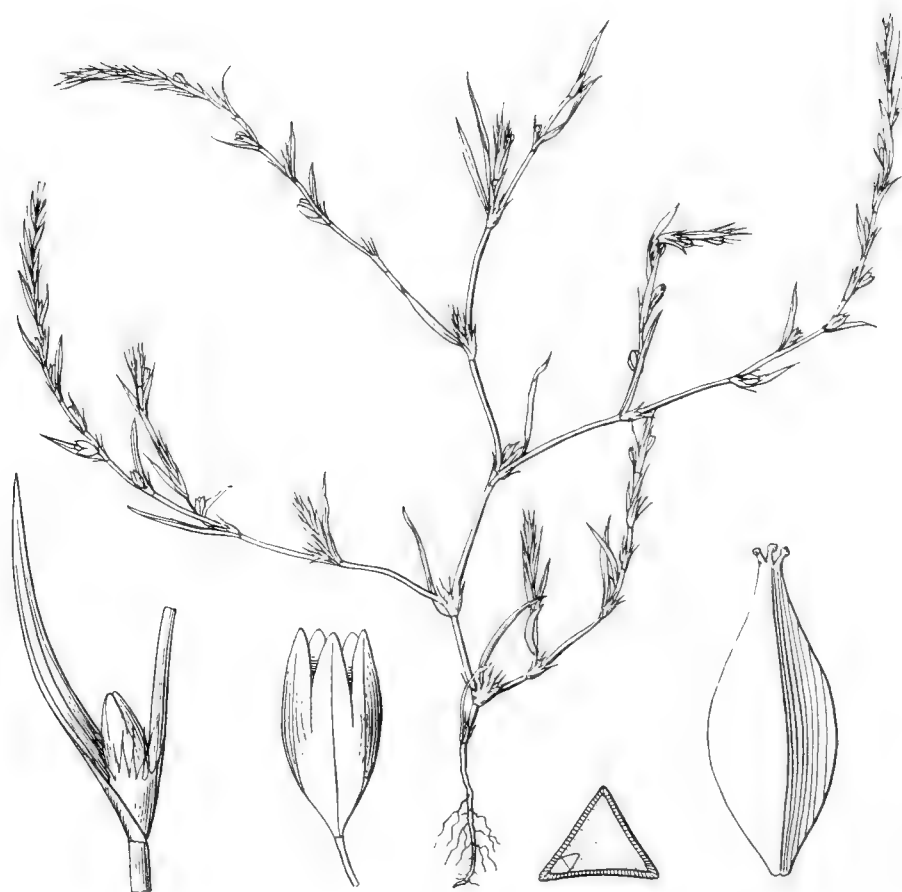
[PLATE 58.]

58. *Polygonum Californicum* Meisner.

Polygonum Californicum Meisner in DC. Prodr. **14**: 100 (1856); Bentham, Pl. Hartw. 334; S. Watson, Proc. Am. Acad. **14**: 295, Bot. Calif. **2**: 13; Behr, Fl. San Fr. 275; Greene, Fl. Francis. 135, Man. Bay Reg. Bot. 41.

Annual, glabrous, very slender and wiry. Stem erect, .8–2 dm. long, flexuous, nearly simple or branched throughout, smooth and shining, sometimes sparingly scurfy, reddish, somewhat four-angled, the branches spreading or ascending; leaves narrowly linear or nearly filiform, 1–3 cm. long, subulate-tipped, with two ribs developed along each margin parallel to the midrib, not articulated to the ocreae, the upper reduced to bracts; ocreae funnelform, 3–4 mm. long, soon conspicuously lacerate, the segments subulate, rather weak; inflorescence consisting of axillary and terminal spikes; spikes slender, 1–7 cm. long, mostly terminal, covered by the imbricated ocreae above; flowers sessile and solitary in each axil; calyx 2.2 mm. long, five-cleft to the middle, at length exceeding the ocreae; stamens eight, included; style .1–.2 mm. long, three-parted, apparently formed by the splitting of the apex of the ovary and achene; achene triquetrous, 2 mm. long, narrowly-oblong, acuminate, included, dark brown or nearly black, mostly smooth and shining.

From the Napa and Sacramento region of California northward to Josephine county, Oregon.



POLYGONUM CALIFORNICUM MEISNER.

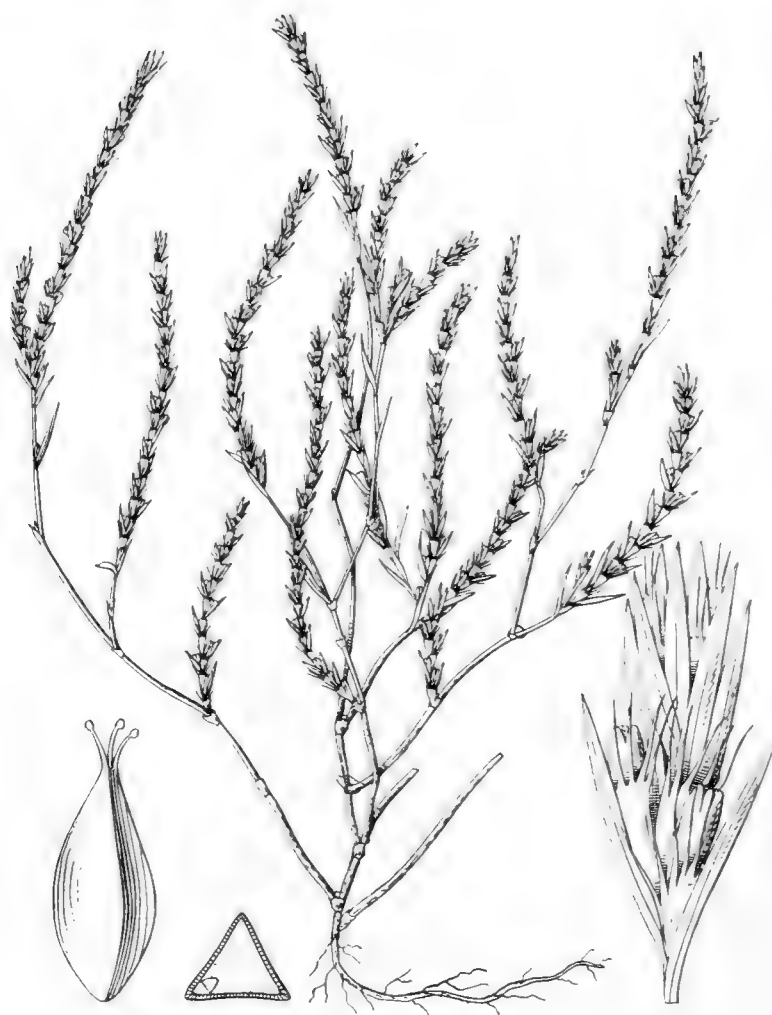
[PLATE 59.]

59. *Polygonum Greenei* S. Watson.

Polygonum Greenei S. Watson, Proc. Am. Acad. 14: 294 (1879); Greene, Fl. Francis. 135.

Annual, glabrous, slender but compact. Stem erect, 1–1.8 dm. long, generally branched throughout, sometimes flexuous, wiry, four-angled or four-winged, reddish; leaves linear-lanceolate or linear, .3–1 cm. long, almost bract-like, reduced to bracts toward the ends of branches, revolute, more or less imbricated and often of much the same size throughout, with two ribs developed along each margin parallel to the midrib, not articulated to the ocreae; ocreae funnelform, 5–8 mm. long, conspicuously lacerate, the segments numerous, subulate, rigid, imbricated and clothing the upper part of the stem, branches and branchlets; inflorescence axillary and terminal, consisting of a single flower at an axil, the ultimate divisions of the stem and branches forming spikes; spikes slender, 1–8 cm. long, covered by the imbricated ocreae; calyx sessile, 2–2.5 mm. long, rose-colored, five-cleft, not exceeding the ocreae; stamens eight, included; style .2 mm. long, three-parted, included, apparently formed by the splitting of the apex of the ovary and achene; achene triquetrous, 2–3 mm. long, narrowly ovoid or ovoid-oblong, dark brown, included, smooth and shining.

From the upper Sacramento Valley, California, to W. Klickitat county, Washington.



POLYGONUM GREENEI S. WATSON.

[PLATE 60. FIG. 1.]

60. *Polygonum Parryi* Greene.*Polygonum Parryi* Greene, Bull. Torr. Club, 8: 99 (1881), Fl. Francis. 135.

Annual, dwarf and compact, glabrous, wiry and rigid, sometimes elongated and straggling. Stem mostly erect, 2–10 cm. long, simple or branched throughout, four-angled, leafy and bearing flowers even to the base; leaves narrowly linear, .5–2 cm. long, of much the same size throughout, subulate-tipped, not articulated to the ocreae, developing two lateral nerves along the margins parallel to the midrib; ocreae funnelform, 3 mm. long, soon extremely lacerate so as to appear cottony, usually hiding the calyx; inflorescence axillary, a single flower arising at each node; spikes usually dense, 1–4 cm. long, clothed with the cottony segments of the imbricate ocreae; flowers sessile in the axils, not exceeding the ocreae; calyx 1.5 mm. long, five-cleft; stamens eight, included; style .1 mm. long, three-parted, the segments apparently formed by the splitting of the apex of the achene, included; achene triquetrous, 1.5 mm. long, broadly oblong or ovoid, somewhat rhombic, dark chestnut, nearly smooth and shining.

From Falcon Valley, Washington, south to the Yosemite Valley, California.

[PLATE 60. FIG. 2.]

61. *Polygonum Bidwelliae* S. Watson.*Polygonum Bidwelliae* S. Watson, Proc. Am. Acad. 14: 294 (1879); Greene, Fl. Francis. 135.

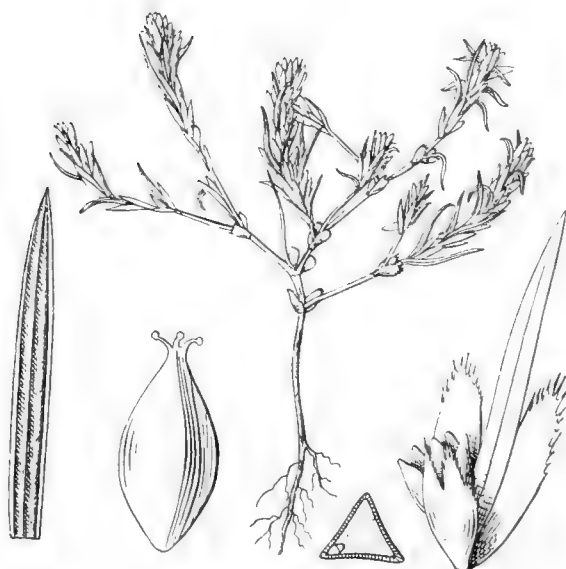
Annual, slender, glabrous and shining. Stem erect, .3–1.2 dm. long, flexuous, four-angled, divergently branched, branches and branchlets equalling or exceeding the stem in length, leafy especially at the ends; leaves linear, .5–1 cm. long, somewhat fleshy, subulate-tipped, more or less reflexed, with two lateral nerves developed on each margin parallel to the midrib; ocreae funnelform, 4 mm. long, silvery and conspicuous, imbricated, two-parted, the principal divisions ovate, at length more or less lacerate and sharply serrate; inflorescence axillary, a single flower borne at each node, the axis of the branch or branchlet shortened so as to form a spike; spikes rather stout, 1–3 cm. long, covered by the conspicuous imbricated ocreae; calyx rose-colored, 1.8–2 mm.

FIG. 1.



POLYGONUM PARRYI GREENE.

FIG. 2.



POLYGONUM BIDWELLIAE S. WATSON.

long, five-cleft to above the middle, hidden in the ocreae; stamens eight, included; style .4 mm. long, three-parted, the segments apparently formed by the splitting of the apex of the ovary or achene, divergent, included; achene triquetrous, 1.7 mm. long, oblong, smooth or minutely granular about the angles and apex.

Vicinity of Chico, California.

[PLATE 61.]

62. *Polygonum Convolvulus* Linnaeus.

Polygonum Convolvulus Linnaeus, Sp. Pl. 364 (1753); Gmelin, Syst. Nat. 2: 639; Willdenow, Sp. Pl. 2: 455; Michaux, Fl. Bor. Am. 1: 241; Persoon, Syn. 1: 441; Pursh, Fl. Am. Sept. 273; Bigelow, Fl. Bost. 94; Muhlenberg, Cat. 41; Elliott, Bot. S. C. & Ga. 1: 459; Barton, Comp. Fl. Phil. 1: 189; Sprengel, Syst. 2: 254; Torrey, Fl. 1: 406, Comp. 173, Fl. N. Y. 2: 146; Beck, Bot. 303; Hooker, Fl. Bor. Am. 2: 131; Meisner, Monog. 62 and in DC. Prodr. 14: 135; Darlington, Florula Cest. 49, Fl. Cest. 252; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 390; Wood, Cl. Bk. Ed. 41, 475. Am. Bot. and Fl. 283; Chapman, Fl. S. States, 390; Darby, Bot. S. States, 491; S. Watson, Bot. Calif. 2: 15; Reade, Pl. Bermud. 68; Behr, Fl. San Francisco, 276; Greene, Fl. Francis. 138.

Annual, glabrous but scurfy, of a dull green or pale green color. Stem prostrate, slender, ascending or twining, 1-12 dm. long, branched from near the root and usually also above or sometimes simple, the internodes of the older branches greatly elongating; leaves broadly or narrowly ovate or ovate-sagittate, the uppermost nearly sagittate, 1.5-6 cm. long, .5-4 cm. broad, acuminate at the apex, cordate or truncate at the base, somewhat undulate and crisped, very slightly ciliate; petioles slender, 1-5 cm. long; ocreae funnelform, oblique, 2-4 mm. long, acute, rough on the edges; inflorescence consisting of axillary clusters or racemes; flowers several in a cluster; racemes simple, 1-6 cm. long, loosely flowered, interrupted; pedicels very slender, 2-3 mm. long, reflexed or deflexed; calyx green, at length 3.5-4 mm. long, five-parted to below the middle or to near the base, closely investing the fruit, the segments oblong, obtuse, the three outer ones sometimes keeled; stamens eight, included; style about .4 mm. long, entire, the stigma three-cleft, somewhat exserted; achene triquetrous, 3.5 mm. long, broadly obovoid or oblong-obovoid, short-pointed, black, granular, rather dull.

Throughout North America, except the extreme north. Naturalized from Europe.



POLYGONUM CONVULVULUS LINNAEUS.

[PLATE 62.]

63. *Polygonum cilinode* Michaux.

Polygonum cilinode Michaux, Fl. Bor. Am. **1**: 241 (1803); Persoon, Syn. **1**: 441; Muhlenberg, Cat. 41; Pursh, Fl. Am. Sept. 273; Bigelow, Fl. Bost. 159; Eaton, Man. 372; Sprengel, Syst. **2**: 254; Torrey, Fl. **1**: 406, Comp. 173; Meisner, Monog. 63 and in DC. Prodr. **14**: 134; Hooker, Fl. Bor. Am. **2**: 131; Beck, Bot. 303; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 390; Wood, Am. Bot. and Fl. 283; Chapman, Fl. S. States, 391.

Annual or perennial, slender, sparingly pubescent throughout, of a reddish or reddish green tint. Stem prostrate or extensively twining, 6–25 dm. long, simple or diffusely branched, red or reddish; leaves broadly ovate or ovate-lanceolate, 2–8 cm. long, 1–6 cm. broad, acute or acuminate, cordate or subcordate, sometimes inclined to be hastate, petioled, undulate, somewhat crisped, minutely ciliate, often prominently nerved on the lower surface; petioles 1–4 cm. long; ocreae funnelform, very oblique, 3–4 mm. long, acutish, fringed with reflexed bristles at the base; inflorescence consisting of axillary and terminal paniced racemes; racemes 1–10 cm. long, loosely flowered, interrupted; pedicels wiry, 3–4 mm. long, reflexed; calyx white, 3–4 mm. long, five-parted to below the middle or near the base, the segments oblong or obovate, obtuse, the three outer ones often inconspicuously keeled; stamens six or eight, included; style .3 mm. long, three-parted to the base, included; achene triquetrous, 3 mm. long, broadly oblong or often approaching ovoid, black, very smooth and shining.

From Nova Scotia and New Brunswick to the Rocky Mountains south to the Great Lake Region; also in and near the Alleghany Mountains.



POLYGONUM CILINODE MICHAUX.

[PLATE 63.]

64. *Polygonum scandens* Linnaeus.

Polygonum scandens Linnaeus, Sp. Pl. 364 (1753); Gmelin, Syst. Nat. 2: 639; Michaux, Fl. Bor. Am. 1: 240; Persoon, Syn. 1: 441; Muhlenberg, Cat. 41; Pursh, Fl. Am. Sept. 273; Bigelow, Fl. Bost. 95; Elliott, Bot. S. C. & Ga. 1: 459; Eaton, Man. 317; Barton, Comp. Fl. Phil. 1: 190; Sprengel, Syst. 2: 254; Torrey, Fl. 1: 406, Comp. 173; Beck, Bot. 303; Meisner, Monog. 64 and in DC. Prodr. 14: 135; Darlington, Florula Cest. 49, Fl. Cest. 252; Eaton & Wright, N. A. Bot. Ed. 8, 368; Wood, Cl. Bk. Ed. 41, 475.

Polygonum dumetorum Torrey, Fl. N. Y. 2: 147 (1834), not Linn.; A. Gray, Man. 390; Chapman, Fl. S. States, 391.

Polygonum dumetorum var. *scandens* A. Gray, Man. Ed. 5, 41 (1867); Wood, Am. Bot. and Fl. 284; S. Watson, Bot. Calif. 2: 15; Coulter, Man. Bot. Rocky Mt. Reg. 521.

Perennial, rather stout, glabrous, more or less scurfy throughout. Stem extensively twining, 6–4 dm. long, sparingly or diffusely branched, somewhat channeled, roughened on the ridges; leaves ovate or oblong-ovate, 1–12 cm. long, .8–7 cm. broad, cordate, acuminate, sparingly scabrous or eroded on the margins, papillose, long-petioled except those on the young branches; petioles 1–10 cm. long, rough on the edges; ocreae funnelform, oblique, 2–4 mm. long, acute, rough on the ridges; inflorescence consisting mostly of axillary clusters and racemes; racemes 3–24 cm. long, interrupted, bearing many large leaves; pedicels slender, 7 mm. long, articulated near the base; calyx greenish-yellow, at length 1 cm. long, five-parted to beyond the middle, the segments ovate, obtuse, the three outer ones keeled and conspicuously winged in fruit; stamens eight, included; style .2 mm. long, entire, the stigma somewhat three-cleft, included; achene triquetrous, 3.5–4.5 mm. long, oblong, often enlarged about the middle, rather blunt at both ends, black, smooth and shining.

From Nova Scotia west to the Rocky Mountains, south to Florida and Louisiana.



POLYGONUM SCANDENS LINNAEUS.

[PLATE 64.]

65. *Polygonum dumetorum* Linnaeus.

Polygonum dumetorum Linnaeus, Sp. Pl. Ed. 2, 522 (1762); Gmelin, Syst. Nat. **2**: 639; Willdenow, Sp. Pl. **2**: 456; Persoon, Syn. **1**: 441; Meisner, Monog. 63 and in DC. Prodr. **14**: 135; Wood, Am. Bot. and Fl. 283.

Perennial, bright green, glabrous throughout, somewhat scurfy, extensively twining. Stem weak, slender, climbing over shrubs and other supports, 6–40 dm. long, much branched, channeled; leaves ovate-cordate, 2–7 cm. long, .5–4 cm. broad, acuminate, petioled or nearly sessile toward the ends of the branches; petioles 1–2 cm. long; ocreae funnelform, oblique, 3–4 mm. long, acute or obtusish, glabrous; inflorescence axillary, consisting of clusters and racemes; racemes 3–8 cm. long, usually numerous, loose, interrupted, bearing a few small leaf-like bracts; pedicels very slender, 5 mm. long, deflexed, articulated near the base; calyx yellowish-green, at length 5 mm. long, five-parted to near the base, the segments oblong, obtuse, the three outer ones keeled and in fruit much enlarged and conspicuously winged; wings crisped; stamens eight, included; style .1 mm. long, three-parted, included; achene triquetrous, 2.5 mm. long, oblong, inclined to be pointed at both ends, black, smooth and shining.

Missouri, Illinois and Tennessee. Also in Europe.



POLYGONUM DUMETORUM LINNAEUS.



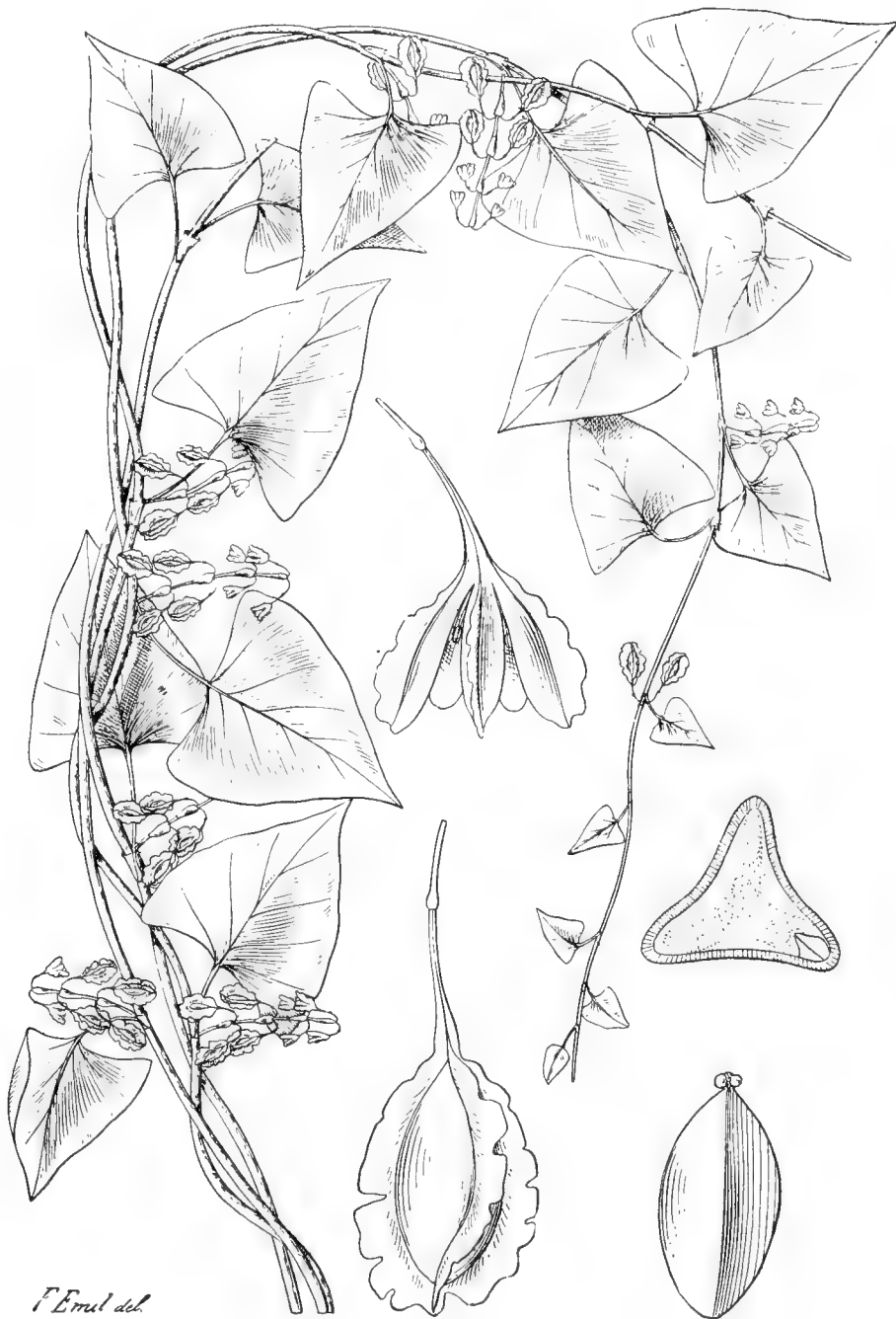
[PLATE 65.]

66. *Polygonum cristatum* Engelmann & Gray.

Polygonum cristatum Engelmann & Gray, Bost. Journ. Nat. Hist. **5**: 259 (1847); Meisner in DC. Prodr. **14**: 136.

Perennial, slender, very scurfy, somewhat rigid. Stem twining, 5–20 dm. long, more or less branched, somewhat channeled and twisted; leaves ovate, triangular-ovate or triangular, 1–6 cm. long, .5–3.5 cm. broad, varying from cordate to truncate, acute or acuminate, undulate and obscurely eroded, short-petioled; petioles slender, 1–2 cm. long; ocreae funnelform or somewhat cylindric, 2–4 mm. long, hardly oblique; flowers in axillary racemes; racemes 2–4 cm. long, loosely flowered, naked, interrupted; pedicels 5 mm. long, very slender, articulated near the middle; calyx greenish white, 4–5 mm. long, five-parted to near the base, the three outer divisions keeled and winged in fruit, the wings more or less incised; stamens eight, included; styles united to the summit; stigmas three; achene triquetrous, 2.5–3 mm. long, oblong, black, smooth and shining.

Texas, Georgia, South Carolina and southeastern New York.



F. Engel del.

POLYGONUM CRISTATUM ENGELMANN & GRAY.



[PLATE 66.]

67. *Polygonum Zuccarinii* Small.

Polygonum cuspidatum Siebold & Zuccarini, Fl. Japon. Fam. Nat. **2**: 84 (1846), not Willd.; Meisner in DC. Prodr. **14**: 135.

Perennial, stout, suffruticose, more or less scurfy. Stem erect, 12–24 dm. tall, at length woody, more or less branched, terete or somewhat angled and channeled, sometimes flexuous; leaves oblong-ovate, orbicular-ovate or ovate-lanceolate, 2–11 cm. long, 2.5–8 cm. broad, short-acuminate, petioled, truncate or subcordate, undulate, conspicuously reticulated on both sides, minutely serrate; petioles 1–3 cm. long; ocreae funnel-form, oblique, 3–4 mm. long, glabrous, early falling away; inflorescence consisting of short axillary and terminal panicle racemes; racemes 6–12 cm. long, more or less pubescent, loosely many-flowered; pedicels about 4 mm. long, articulated near the middle; calyx greenish white, 8–9 mm. long, five-parted to below the middle, the outer segments very broadly winged in fruit; stamens eight, included; style .9 mm. long, three-parted to near the base, included; achene triquetrous, 3 mm. long, narrowly oblong, black, smooth and shining.

Vicinity of Philadelphia, Pennsylvania; Schenectady, New York, and Atlantic Highlands, New Jersey. Naturalized from Japan.



POLYGONUM ZUCCARINII SMALL.

[PLATE 67.]

68. *Polygonum Meisnerianum* Beyrichianum (Chamisso & Schlechtendal) Meisner.

Polygonum Beyrichianum Chamisso & Schlechtendal, *Linnaea*, **3**: 42 (1828).

Polygonum multangulare Hooker & Arnott, *Comp. Bot. Mag.* **2**: 62 (1836).

Polygonum Meisnerianum var. *Beyrichianum* Meisner in Mart. Fl. Bras. **5**: 19 (1855).

Polygonum Chamissoanum Steudel; Meisner, Mart. Fl. Bras. **5**: 20 (1855).

Polygonum geniculatum Riddell; Meisner, Mart. Fl. Bras. **5**: 20 (1855).

Perennial, slender and somewhat wiry, nearly glabrous except the inflorescence and prickly stem. Stem 5–10 dm. long, reclining, dichotomously branched, somewhat enlarged at the nodes, rather sharply angled, the angles mostly armed with recurved prickles; leaves linear or linear-lanceolate, subsagittate, 3–15 cm. long, .4–1.5 cm. broad, acute or acutish, subsessile, cordate and more or less clasping, almost glabrous on the upper surface, glabrous beneath except the midrib which is sometimes sparsely pubescent with prickle-like hairs, glandular-ciliate; ocreae cylindric, 1–2 cm. long, somewhat obliquely opened and spreading at the summit, naked, very thin, fringed around the base with small recurved prickles; inflorescence dichotomous, more or less compound, the ultimate divisions ending in clusters or spicate racemes; peduncles glandular; racemes .5–1 cm. long, few-flowered; ocreolae 1 mm. long, ciliate; pedicels .8–.9 mm. long; calyx rose-colored, campanulate, five-parted to the middle, 2–3 mm. long, the segments ovate-oblong, obtuse; stamens five, included; style .5 mm. long, three-parted, included; achene varying from broadly ovoid to obovoid, triquetrous, dark brown, smooth and shining, the faces convex, the angles obtuse.

Louisiana to Texas and Mexico southward to Brazil. Also in the West Indies.



POLYGONUM MEISNERIANUM BEYRICHIANUM (CHAMISSE & SCHLECHTENDAL) MEISNER.

[PLATE 68.]

69. *Polygonum sagittatum* Linnaeus.

Polygonum sagittatum Linnaeus, Sp. Pl. 363 (1753); Gmelin, Syst. Nat. **2**: 638; Walter, Fl. Car. 132; Willdenow, Sp. Pl. **2**: 453; Michaux, Fl. Bor. Am. **1**: 241; Persoon, Syn. **1**: 441; Muhlenberg, Cat. 41; Pursh, Fl. Am. Sept. 272; Bigelow, Fl. Bost. 94; Elliott, Bot. S. C. & Ga. **1**: 458; Barton, Comp. Fl. Phil. **1**: 189; Eaton, Man. 372; Sprengel, Syst. **2**: 254; Torrey, Fl. **1**: 407, Comp. 173, and Fl. N. Y. **2**: 148; Meisner, Monog. 64 and in DC. Prodr. **14**: 132; Hooker, Fl. Bor. Am. **2**: 131; Beck, Bot. 302; Darlington, Florula Cest. 48, Fl. Cest. 251; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 390; Wood, Cl. Bk. Ed. 41, 475, Am. Bot. and Fl. 284; Chapman, Fl. S. States, 390; Darby, Bot. S. States, 490.

Polygonum sagittatum var. *boreale* Meisner, Monog. 65 (1826).

Polygonum sagittatum var. *Americanum* Meisner in DC. Prodr. **14**: 132 (1856).

Polygonum sagittatum var. *pubescens* Keller, Bull. Soc. Bot. Belg. **30**: 45 (1891).

Annual, glabrous, bright green throughout or parts tinged with red. Stem slender or stout, decumbent, ascending or reclining, 3–15 dm. long, simple or much branched, four-angled and finely channeled, armed on the angles with sharp recurved prickles, by which the plant climbs, the length of the internodes variable on the same plant; leaves lanceolate or oblong, sagittate, 1–12 cm. long, .5–3 cm. broad, cordate, the lower ones long-petioled, the upper short-petioled or sessile, obtuse or acute, lighter green on the lower than on the upper surface, slightly roughened on the edge by small prickles; petioles 1–5 cm. long, armed, as well as the midrib, with small recurved prickles; ocreae funnelform, very oblique, .5–1 cm. long, acute, smooth, eciliate; inflorescence terminal, consisting of capitate sometimes panicled clusters; ocreolae bract-like, lanceolate, 3–5 mm. long; pedicels 1.5 mm. long; calyx white, green or red, 4 mm. long, five-parted to below the middle, the segments oblong, obtuse; stamens eight, included; style .9 mm. long, three-parted to below the middle, included; achene triquetrous, 3–3.5 mm. long, ovoid, sharp-pointed, black or brownish, smooth and shining.

Newfoundland to the Saskatchewan south to Florida and Texas.



POLYGONUM SAGITTATUM LINNAEUS.

[PLATE 69.]

70. *Polygonum arifolium* Linnaeus.

Polygonum arifolium Linnaeus, Sp. Pl. 364 (1753); Gmelin, Syst. Nat. 2: 638; Walter, Fl. Car. 132; Willdenow, Sp. Pl. 2: 453; Michaux, Fl. Bor. Am. 1: 241; Persoon, Syn. 1: 441; Muhlenberg, Cat. 41; Pursh, Fl. Am. Sept. 272; Bigelow, Fl. Bost. 94; Eaton, Man. 372; Elliott, Bot. S. C. & Ga. 1: 459; Barton, Comp. Fl. Phil. 1: 189; Sprengel, Syst. 2: 258; Torrey, Fl. 1: 407, Comp. 137, Fl. N. Y. 2: 148; Beck, Bot. 303; Darlington, Florula Cest. 48, Fl. Cest. 251; Meisner, Monog. 65 and in DC. Prodr. 14: 134; Eaton & Wright, N. A. Bot. Ed. 8, 368; A. Gray, Man. 389; Wood, Cl. Bk. Ed. 475, Am. Bot. and Fl. 284; Chapman, Fl. S. States, 390; Darby, Bot. S. States, 490.

Perennial or annual, glabrous below, bright green. Stem ascending and reclining, 2-9 dm. long, nearly simple or much branched, channeled and armed on the four angles with stout recurved prickles, the peduncles and pedicels glandular or pubescent; leaves broadly hastate, 2-18 cm. long, 1-16 cm. broad, cordate or subcordate, pubescent or glabrous on the lower surface, more or less constricted below or about the middle, the thin lobes acuminate; petioles 1-2 cm. long, these as well as the midrib and principal nerves of the leaf armed with recurved prickles; ocreae funnelform, oblique, .5-1 cm. long, fringed at the summit with short bristles and at the base with short bristle-like prickles; inflorescence terminal and axillary, consisting of suppressed paniced racemes or subcapitate clusters; racemes 1-2 cm. long, somewhat leafy, interrupted; bracts funnel-form, oblique, 2 mm. long; pedicels 2 mm. long; calyx greenish or rose-colored, four-parted to below the middle, the segments oblong, obtuse; stamens eight, included; style .5-6 mm. long, two-parted to the base, included; achene lenticular, 4 mm. long, obovoid or oblong-ovoid, dark brown or variegated, very smooth and shining.

New Brunswick to Minnesota south to South Carolina.



POLYGONUM ARIFOLIUM LINNAEUS.

THE COMPARATIVE ANATOMY.

The following examples have been selected as being most typical of the subgenera they respectively represent. In the case of subgenera that contain few and similar species, the anatomical structure of the type selected seems to be fairly constant. On the other hand, in the large subgenera which contain numerous species different in appearance and either erect or prostrate in habit, we cannot hope to find the structure very uniform. Therefore, in any conclusions reached in this study as regards subgenera, this fact must be considered. The comparisons as recorded below may be regarded as nearly correct, for the material studied was taken from practically the same portion of the stem in each case, and is almost without exception of about the same age.

SUBGENUS BISTORTA.

Polygonum bistortoides. We are here concerned with an erect unbranched axis. The stem is rather rigid and has to support its leaves and terminal raceme as well as to maintain its erect position. The epidermis averages about $12\ \mu$, and the periblem derivatives measure from $25\text{--}95\ \mu$. The pleromatic cylinder is strong, the stereome elements forming a continuous sheath ranging from $40\text{--}100\ \mu$, while the xylem attains a maximum diameter of $150\ \mu$.

The epidermis is simple, its cells being parallelopipeds or prisms, sometimes measuring $15\ \mu \times 10\text{--}20\ \mu$ broad and $40\text{--}70\ \mu$ high. Their septa are either square or a little oblique, and in cross section they vary either way from equilateral. Trichomes exist as elongated unicellular hairs with blunt apices. On the stem they are found only on the younger parts about the inflorescence and are non-glandular.

The next zone, the primary cortex, is clearly marked off from the epidermis. In many instances the cells of the hypoderma are only one-half as large as the overlying ones, and vary from somewhat prismatic to lenticular-vermiform. They lie in two to seven rows, and have these dimensions: $5\text{--}10\ \mu \times 10\text{--}20\ \mu \times 30\text{--}40\ \mu$. The starch-ring follows and normally consists of a single layer of cells which are larger than those of either of the outer tissues; their shape is mostly oblong and their size $12\text{--}25\ \mu \times 15\text{--}30\ \mu \times 40\text{--}95\ \mu$.

A wide zone ($40\text{--}100\ \mu$) of sclerenchymatic cells begins the pleromatic cylinder. The cells are prisms, ranging from $10\text{--}30\ \mu$ in diameter, and from $150\text{--}330\ \mu$ in height,

many-sided and closely packed, and the angles are either obtuse or somewhat rounded. The smallest and strongest stereids exist just at the outside of the bundles. Here the thickness of the wall or that of the two contiguous walls exceeds the diameter of the cavity; indeed many of the cavities are almost obliterated and only between the bundles do the cells become larger and thinner-walled. At these places, the stereome often interrupts the xylem and meets the pith. The septa are almost invariably transverse. The phloem occurs as fascicles between the stereome and xylem; in cross section it appears as either rounded or linear areas, and in the specimens studied it either remained as very angular cells (in cross section) or it had all disintegrated leaving only large cavities. There is a variable development of xylem. The woody fibres are typical, varying in length from 150–400 μ , and the ends taper in the great majority of cases. In cross section these elements appear as square or oblong, in which case their longer axes are radial and the diameters usually keep within the bounds of 5–10 μ . The tracheides and vessels are more or less prismatic, and range from 20–40 μ in diameter. They especially characterize the region just external to the protoxylem. These elements are surrounded by either wood-parenchyma or woody fibres. The tracheides average about 400 μ in length, and have transverse or oblique septa. They are not plentiful and usually have small diamond-shaped border-pits. The arrangement of the tracheides and vessels in this subgenus generally appears as represented in the accompanying plate. Toward the outside of the bundles we find spiral vessels, the spiral markings being either close or open. Further in are small vessels with heavy annular markings, while still deeper we find vessels which begin with annular markings which grade into spirals.

The wood-parenchyma, except near the pith, consists of long cells (200–350 μ), which sometimes almost rival the woody fibres in length, but they usually have square ends and thin walls. At the depressed semi-circular inner sides of the collateral bundles the cells of this tissue are larger, but shorter, and gradually or abruptly pass into the pith. The parenchymatous cells of the pith are either parallelopipeds or rarely cubes, and measure from 70–150 μ in length. It may be well to note here that the pith of the section illustrated is from the vicinity of a node and therefore more angular than it would appear if taken from the middle of an internode.

SUBGENUS ACONOGONON.

POLYGONUM ALPINUM. In this case we have a plant that agrees with the preceding species in habitat, but instead of being simple the stem is more or less branched, as well as the inflorescence, and therefore the axes are subjected to greater strain. The epidermis varies from 20–30 μ . The periblematic cylinder averages about 90 μ . A stereome

cylinder and the xylem make the pleromatic part a strong sheath measuring from 100 to 350 μ .

The cuticle is conspicuously ribbed or longitudinally furrowed between the epidermal elements. The epidermis is composed of one row of oblong-prismatic cells, which in cross section are quite irregular, and the long diameter is often radial, in this, as well as in their irregular prismatic shape, differing from most of the other species examined; their height varies from 50–70 μ . Trichomes occur as long bristle-like hairs, are unicellular and more or less curved upward.

The periblematic cylinder follows the epidermis, and is easily distinguished from the latter on the one hand and the plerome derivatives on the other. The primary cortex, excepting the starch-ring, is made up of from three to seven layers of cells, which are prismatic, varying from 70–160 μ in height, and in cross section have a diameter varying from 5–40 μ , appearing irregular and rather angular or vermiform and near the epidermis are placed with their long axes radial, while further in they lie in the normal position. The starch-ring is conspicuous in both cross and long section. It consists normally of one layer of cells, but between the bundles it often increases to a thickness of three; the cells are cylindric or prismatic, having a diameter of from 10–60 μ and a height ranging from 70–150 μ , and are strikingly larger than the neighboring elements of the primary cortex.

The pleromatic cylinder has all its parts well developed. The stereome is composed of prismatic stereids, with rounded angles in cross section, forming a sheath one to four cells deep. The cells are from 10–40 μ in diameter and 200–300 μ high. The cylinder is continuous and most compact at the outside of the bundles, while between the latter the cells are larger and not as closely packed, and as is the case in section *Bistorta*, the septa are almost invariably transverse. The phloem is conspicuous as narrow fascicles toward the outer sides of the bundles. Between the latter it is interrupted for short distances by the intrusion of the stereome cylinder. The sieve-tubes and cells of the phloem are prismatic and in cross section appear quite angular, measuring from 5–10 μ in diameter; in favorable sections they are distinct and vary in length from 100–160 μ . The woody fibres in cross section are either square or oblong, and lie with their short axes radial. They are smallest and most compactly arranged at the centers of the bundles, and range from 5–10 μ in diameter. The ends are either oblique or tapering. As in the preceding subgenus, the tracheides and vessels occur normally along a line on either side of which the woody fibres and protoxylem are respectively situated. These large elements of the tracheae measure from 30–70 μ in diameter and are either nearly circular in cross section or somewhat prismatic. In long section various combinations of the tracheides and vessels are found. Four different kinds are sometimes met with as repre-

sented in the accompanying plate. The tracheides usually have oval border-pits, and vary in length from 250–350 μ . Three kinds of vessels are here represented: first, those with annular markings, which either continue as such or merge into spirals; second, close spirals, and third, scalariform. These are sometimes accompanied by woody-fibres or by wood-parenchyma; the latter constitutes the great bulk of the inner sides of the bundles, and in cross section appears as large semicircular accumulations of round prismatic cells, which gradually or abruptly merge into the pith. The pith is composed of large prismatic cells, 70–200 μ long and with four to eight sides, having a maximum diameter of 120 μ ; numerous resin canals occur in this tissue.

SUBGENUS PERSICARIA.

POLYGONUM PENNSYLVANICUM. The species of this subgenus are usually much branched, thus bringing more or less strain on the main axes. To resist this strain and to maintain an erect position, we find a strong development of strengthening tissues. The epidermal and periblematic cylinders range from 120–150 μ , while the pleromatic parts are especially stout, reaching a thickness of over 400 μ .

A simple epidermis occurs, although in some sections it appears to be double, but a long section of the same part shows the apparent second layer to be composed of cells of the primary cortex which have become somewhat larger than the rest. The epidermal cells are parallelopipeds, 5–15 μ thick, 30–50 μ broad and 50–70 μ high.

The primary cortex is strongly developed, consisting in the specimen examined of from seven to ten layers of small oblong-lenticular cells, those near the epidermis being usually larger than the rest, as above stated; the cells vary in diameter from 5–20 μ and in length from 20–40 μ . There is a great contrast between the hypoderma and the starch-ring; in this the cells are very large, measuring from 10–70 μ in diameter and 70–120 μ high; they are either square-angled parallelopipeds or irregular prisms; their normal distribution is in one layer, but between the bundles they break through the stereome cylinder and come into contact with the phloem, thus increasing to several layers. The stereome is strong here, but rather peculiarly arranged, and will be mentioned again in discussing the xylem. The stereids are in the form of long prisms, with transverse or oblique ends, ranging from 200–300 μ . Their diameters vary from 15–20 μ , and in most cases the walls are so thick that they almost obliterate the cavities. The amount of phloem just inside the stereome cylinder is remarkable; in the stem sectioned the zone was nearly continuous and measured from 40–100 μ ; the elements are variable in size, some being only 5 μ in diameter, others reaching 15 μ or more. In long section the sieve tubes appear to range from 150–250 μ in height, and the septa are either transverse or

oblique. The tubes are surrounded by accompanying tissue, whose length is several times shorter than that of the former elements. A thick zone of xylem follows the phloem. The woody fibres are small in cross-section ($5-15\ \mu$ in diameter), oblong, with the longer axes radial; they are typical in all respects, and vary in length from $250-350\ \mu$. Small but distinct bundles exist between the large ones, and have their system of tracheae and wood-parenchyma. Radially from the large bundles the phloem breaks through the stereome cylinder, and meets the starch-ring, while radially from the small bundles the starch-ring interrupts the stereome and comes into contact with the phloem. An arrangement of the tracheides and vessels exists, different from that of the two preceding subgenera. Instead of being situated about a line where the woody fibres and wood-parenchyma respectively predominate, they are scattered throughout the bundles. We meet few tracheides, but numerous vessels. The former have small diamond-shaped markings, and the latter various kinds of spirals. Only a few annular markings were observed in the sections cut, and these were connected with either single or double spirals. Toward the outside of the bundles rather open and double spirals occur, and further in come the close and open single spirals; the latter and the double open spirals seem to be stouter than the others. Wood-parenchyma and intermediate tissue constitutes the bulk of the inner sides of the bundles, and are arranged so that in cross section they appear as flat semicircular projections into the pith.

The pith is different from that described under the two preceding subgenera. After passing a row of more or less elongated parenchymatous cells, we find it made up of nearly isodiametric elements, although in the young state they may be much longer than broad.

SUBGENUS TOVARA.

POLYGONUM VIRGINIANUM. A plant somewhat resembling the preceding and called on to bear about the same kind of a strain by the branching of its summit into long virgate racemes which, unless properly supported, would bear down the main axis. We find the general structure of this stem much the same as that of *P. Pennsylvanicum*, the epidermal and periblematic cylinders are not as thick ($50-100\ \mu$), but the pterome derivative is much thicker, running as high as $500\ \mu$.

The cells of the epidermis are small parallelopipeds, ranging from $5-20\ \mu$ in diameter and from $10-20\ \mu$ in height.

The primary cortex appears normal in cross section, the cells, excepting those of the starch-ring, varying from $10-20\ \mu$ in diameter and are three or four layers thick; they are quite rectangular in outline, and only prismatic near the starch-ring. In long section, however, they are extraordinary, appearing almost like fibres and measuring from $250-$

350 μ in length. The starch-ring is made up of elements much larger than those of the two preceding zones. The cells are prismatic, often quite irregular, varying from 20–50 μ in diameter, while the average length is about 50 μ ; they are disposed in one row except between the bundles, where they become several rows deep, and here and there at intermediate points we find them either two deep or wanting, in which case the stereome and hypoderma meet. Where the starch-ring interrupts the stereome cylinder it comes into contact with the xylem, and as in the case of *P. Pennsylvanicum* the starch-ring sometimes meets the phloem; in this case, however, the latter is the projecting part.

A stout sheath of stereids makes up a stereome cylinder and begins the plerome derivatives; the elements are very similar to those of the preceding subgenus in size, shape, and thickness of the wall; the cavities are usually almost obliterated, and the diameter of the cells varies from 10–30 μ , while their length ranges from 200–300 μ ; the septa are either square or oblique. The phloem occurs as small fascicles, oblong in cross section. The amount of this tissue is very small, compared with subgenus *Persicaria*, and the elements are quite angular; the sieve-tubes measure from 140–210 μ in length. The xylem is strongly developed and similar to that of the preceding, except that the woody fibres and wood-parenchyma are slightly larger. The woody fibres are typical and have, with the exception of some near the stereome cylinder and about the larger elements, their long diameters radial in cross section. Here the tracheides are somewhat shorter than in *P. Pennsylvanicum*, but the markings are about the same; we find both annular and spiral markings, the former further out in the bundles; all the spirals are close, and no open nor double ones such as exist in *Persicaria* were found.

It is significant that the pith merges into the surrounding tissue through the same kind of cells as it does in *P. Pennsylvanicum*, and more than this, in most of the sections the parenchymatous cells of the pith are more or less oblong, but here they are almost invariably broader than high and somewhat hexagonal.

SUBGENUS AVICULARIA.

POLYGONUM AVICULARE. Many species of both prostrate and erect habit are included in this subgenus. A prostrate plant has been selected for a representative here because most of our other species are of erect habit. The stems are more or less wiry and tough, but are not called on to withstand much strain except at the ends, where they are somewhat assurgent; however, as growth continues they become prostrate. We find a strong development of tissues here, with the exception of the stereome parts. The epidermis averages about 15 μ , the derivatives of the periblem 50–80 μ , and those of the plerome vary from 200–250 μ .

A simple epidermis encloses the primary cortex. The cells are parallelopipeds having a diameter of from 10–20 μ and a height ranging from 40–70 μ . In cross section they vary on either side of equilateral, the long axis sometimes being tangential, sometimes radial. Just within the epidermis, at intervals corresponding radially with the collateral bundles, we find fascicles of sclerenchymatous cells, which are bounded within by either the ordinary cells of the primary cortex or by a layer of epidermal-like cells. These fascicles, as will be seen from the plates, both in their position and structure are exceptionally fine illustrations of the mechanical arrangement of the stereome, and produce the ridges so conspicuous on many of the stems in subgenus *Avicularia*. Following the epidermis and the above-mentioned sclerotic elements is the primary cortex, which varies in thickness from two to eight cells, the arrangement of which differs from all other specimens examined; instead of having their long axes parallel to the length of the stem, they lie in the opposite position and contrary to what we usually see; in cross section the cells appear oblong or vermiform, while in long section they are more or less polyhedral and isodiametric; their width is a little less than one-half that of the epidermal cells. The starch-ring, whose continuity is occasionally interrupted by the bundles of stereids, is made up of prismatic or lenticular cells ranging from one to three layers deep. The cells of the outer layer, which are larger than the rest, are somewhat shorter and a little more irregular than the epidermal cells.

The stereome does not form a cylinder in this subgenus, as it does in most others, but consists of fascicles ranging from 50–100 μ in diameter and separated by the elements of the starch-ring. These fascicles and those in the periblematic cylinder are of about the same size and correspond radially. Their stereids are of the normal type in the genus, varying from 10–20 μ in diameter, with the cavity almost obliterated and ranging in length from 170–260 μ . Just within the bundles of the stereome there occurs a great development of phloem; the elements are remarkably small and seldom reach 10 μ in diameter. The phloem is thickest about the bundles of sclerotic cells, whence it gradually thins out but forms an almost continuous sheath. In long section the sieve-tubes are distinct and measure from 150–200 μ in length, and the septa are usually somewhat oblique. A strong growth of xylem is opposed to this sheath; the woody fibres are typical, mostly having tapering ends and varying from 200–250 μ in length; in cross section they are either square or oblong; in the latter case the long axes are radial; their diameter ranges from 5–15 μ . Scattered throughout are the larger elements, which appear more or less prismatic in cross section, measuring from 15–40 μ in diameter. Towards the outside of the bundles we find narrow tracheides with small border pits, and a little further in compact spiral vessels. As we approach the region of the wood-

parenchyma, open spirals appear. There may be either double or single spirals, and as was the case in other subgenera, the single spirals are always the heavier. The wood-parenchyma grades into the pith; it is plentiful about the inner sides of the bundles, and its cells have a length of 200–300 μ .

The pith differs somewhat in character from any described under the foregoing subgenera; the cells are much more elongated, and their form is either cylindric or prismatic, averaging about 200 μ in length, or three to five times as long as broad.

SUBGENUS DURAVIA.

POLYGONUM CALIFORNICUM. This section, containing the smaller plants of the genus, exhibits a very peculiar structure, differing in some respects from all the others. The plants are low, slender and wiry, and often seem to strive to spread and grow erect at the same time; they have, however, a strong anatomical structure, but this strength seems unnecessary.

The epidermis averages about 15 μ . The primary cortex ranges from 10–90 μ , this great variation being caused by the existence of wings and ridges which will be discussed later. The xylem varies from 40–100 μ .

Here, as in the case of *P. alpinum*, we find strikingly prismatic epidermal cells, and here, too, their long axes are usually radial in cross section. The minute size of the stem will be understood when the accompanying plate is compared with the others, for it is drawn to the same scale. The cells of the epidermis in *P. Californicum* exceed some and rival others of those of much larger plants; their length is from 40–60 μ . Depressed conical trichomes are borne on some of the cells, and appear almost like papillae.

As a second peculiarity we meet a curious form of primary cortex. The cells outside of the starch-ring are flat-lenticular and placed with their long axes radial. Their tangential diameter averages about 5 μ , while the radial varies from 10–30 μ . In long section they appear to be arranged more or less obliquely; this seems to depend, however, on the rate of growth of the surrounding parts. We observe a modification in this species seen only in the one preceding: at four or more points (usually four) a bundle of sclerenchymatous cells exists just outside of the starch-ring. Opposite to these bundles the primary cortex is thickest and forms ridges or wings. The elements of these bundles in long section appear to be the same as those composing the stereome in other subgenera; their diameter is a little less than 10 μ , and the length varies from 80–120 μ ; the septa are either transverse or oblique. One layer of oblong-prismatic cells makes up the starch-ring; their length ranges from 20–30 μ , and their breadth is about one-half of their length.

Small and indistinct fascicles of phloem exist in their normal places inside of the

starch-ring. The xylem is unusually strong, as will be seen by the accompanying plate. The woody fibres have apparently become stereids, mostly with tapering ends; the cavities are either of about the same thickness of the walls or are nearly obliterated; the diameter ranges from 10–15 μ , and the length averages about 200 μ . The tracheides and vessels extend throughout the collateral bundles, and sometimes even interrupt the starch-ring; they vary from the same size as the woody fibres to 20 μ in diameter. Far out in the xylem we meet with small annular vessels with very faint markings. Further in come open spirals with stout markings, while still nearer the centre are close spirals and tracheides with very small border-pits.

The pith in this instance agrees well with that of section *Avicularia*, the cells being many times longer than broad, measuring 10–30 $\mu \times$ 50–250 μ .

SUBGENUS TINIARIA.

Polygonum scandens. In place of an erect or prostrate stem, we have in this case one which climbs by twining. The epidermis varies from 20–25 μ . The periblematic cylinder is weak and reaches a thickness of only 50 μ . The plerome derivatives do not exhibit any strong characters, and are from 25–45 μ in thickness, excluding the pith.

The epidermis consists of a single row of cells measuring from 60–110 μ in length; they are somewhat irregular in long section, especially about the ends, and in cross section vary from nearly square to oblong, and are generally about 20–23 $\mu \times$ 30–50 μ . Trichomes in the shape of unicellular cones arise from the epidermis in such numbers as to give it a scurfy appearance; these hairs are not much elongated, and usually have an erect tendency. Following this is the primary cortex, made up of irregular lenticular cells, and in comparison with that of other subgenera poorly developed; its depth never increases to more than two cells, and these are only about 10 μ thick; their length and breadth vary from 20–70 μ . The starch-ring is variable, in some cases, as represented in the cross section figured, it is quite narrow and weak, while in others, as we see in the long section, it is strong and regular. This is never more than one layer of cells, and these are either irregularly prismatic or lenticular.

Taking up the plerome derivatives, we meet with an extensive though structurally weak development of sclerotic tissue. The stereids are, as usual, prismatic, measuring from 20–70 μ in diameter and 250–400 μ in length, and lying in from three to five rows; the septa are transverse or oblique and the cavities large; the structure differs in this respect from that of all other subgenera, and the cell walls are seldom over 5 μ thick; they either come into contact with the xylem or phloem. In the stems sectioned this latter tissue had fallen away, leaving only large cavities. The fascicles of phloem in this

species are not situated radially to the centre of the collateral bundles, as is usually the case, but they are quite a distance off to one side, this deviation being due apparently to the torsion of the twining stem. The xylem is more or less extensive but weak, large portions of it appearing more like wood-parenchyma than like true woody fibres. The fibres are large, $10\text{--}20\ \mu$ in diameter and $200\text{--}250\ \mu$ in length; the septa are either transverse or oblique, and we find no real tapering ends; in cross section they appear square or oblong, with the long axes radial. The larger tracheae are not plentiful, and most of them exist in the ends of the bundles which penetrate the pith as long sharp wedges. However, we find all the varieties represented; furthest out are the spiral vessels, near these occur border-pitted vessels of about the same calibre; in the midst of the wood-parenchyma are small tracheides more or less strongly marked with border-pits, and we find large scalariform tracheides which may merge into those marked with border-pits. Weak annular vessels exist near the pith, and their markings are often very faint. The diameter of the tracheides and vessels varies from $20\text{--}50\ \mu$ in extreme cases.

After passing a row of large ($110\ \mu \times 70\text{--}120\ \mu$) parenchymatous cells, the pith consists of cylindric or prismatic cells which measure as high as $100\ \mu$ in diameter and vary from $250\text{--}350\ \mu$ in height.

SUBGENUS ECHINOCaulon.

Polygonum arifolium. Plants with weak stems and a reclining habit constitute this subgenus. They usually grow in damp or wet places and climb over surrounding objects by means of recurved prickles. We find here quite a characteristic anatomical structure. The epidermis is double, averaging about $50\ \mu$. The periblematic cylinder is not well developed and measures from $50\text{--}70\ \mu$. The plerome derivatives are strong, ranging, with the exception of the pith, from $200\text{--}350\ \mu$, and each part is well developed.

This is the only instance where I have found a double epidermis; the inner layer of cells is somewhat larger than the outer, the difference often amounting to $10\ \mu$; their diameter ranges from $10\text{--}30\ \mu$ and their length from $40\text{--}80\ \mu$. Four kinds of trichomes spring from the epidermis: First, we have simple multicellular hairs with long sharp points; second, somewhat stouter hairs which fork into from two to six prongs; third, long glandular trichomes bearing yellow or black glands at the apices, and finally prickles, which are more or less recurved.

The primary cortex is rather meagre, but in some long sections prominent. The cells are long prisms of various shapes and sizes; their diameter ranges from $10\text{--}70\ \mu$, and their length from $30\text{--}150\ \mu$. The elements of the starch-ring do not differ much from those of the hypoderma; they have, on the whole, a greater diameter and vary from

80–100 μ in length; their shape is a little more regular than that of the elements of the preceding tissue and often approaches a cylindric form.

The stereome cylinder is strong and continuous, varying from three to five cells deep and from 80–150 μ in thickness. The stereids are prismatic, sometimes tapering, many-sided and, as a rule, large, some reaching 50 μ in diameter; 250–350 μ covers their length, and the septa are oblique. The large ones between the bundles are often inconspicuous both on account of the width of the cells and the extent of their cavities, while in others the cavity is almost obliterated. The stereome is mostly followed by the xylem, but small fascicles of phloem do occur in their normal positions. These fascicles measure from 40–100 μ in diameter and often contain only a dozen elements. In favorable long sections the sieve-tubes are distinct, varying from 150–250 μ in length. As the xylem appears in cross section, one would expect to find the tracheae strongly marked; the woody fibers are remarkably large, thick-walled and short; in cross section they appear as square or oblong cells (long axes tangential) ranging from 10–40 μ in diameter; the walls and cavities are usually of about the same thickness; in long section some of the tracheids appear as vermiform fibres ranging from 150–250 μ in length but strongly marked with border-pits. No large tracheides were observed in the stem sectioned, but vessels were plentiful; they are of irregular prismatic shapes and placed in rather an irregular manner; their diameter ranges from 20–60 μ , and we find large and small spiral, large annular and scalariform vessels. Wood-parenchyma is almost abundant towards the inner sides of the bundles, and is usually quite distinctly differentiated from the pith. A row of cells similar to those in subgenera *PERSICARIA* and *TOVARA* separate these two tissues.

A regular and large-celled pith occurs. The cells are oblong prisms with a diameter of from 40–120 μ and a height varying from 150–200 μ .

Grouping the subgenera, according to their anatomical structure, we can bring the eight under five divisions. First: We see that *P. bistortoides* and *P. alpinum*, representing subgenera *BISTORTA* and *ACONOGONON*, agree in these respects: the primary cortex is much the same, although that of *P. alpinum* is somewhat more angular; the stereome cylinder is continuous in both, and its elements in cross section have a more rounded and less angular appearance than in any other subgenus; phloem appears in the same kind of fascicles; the xylem is practically alike in both, its tracheides and vessels exist in about the same position, and the inner sides of the bundles have the same semicircular shape and pass into the pith through a row of similar parenchymatous cells.

Second: The next natural grouping brings in *P. Pennsylvanicum* and *P. Virgini-*

anum. After passing a somewhat different epidermis and hypoderma, we meet with quite similar starch-rings and stereome cylinders, the latter being very compact and rigid, the elements small, angular, and of much the same size throughout; again passing a difference in the arrangement of the phloem, the xylem appears strikingly similar in both, with its system of tracheides and vessels disposed in the same manner; the xylem merges into the pith through a cylinder of the same kind of cells, and in both species the latter tissue appears about the same in cross section, its difference in long section being mentioned under the head of the subgenus TOVARA.

Third: This division will include the subgenera AVICULARIA and DURAVIA. These two are not thrown together on account of the similarity of their respective tissues, but on account of the stereome development in the primary cortex. The phloem is peculiar in each case, while in AVICULARIA the xylem is normal, but in DURAVIA it is not what we should expect to find.

Fourth: *P. scandens* falls in here with its large-celled epidermis, its often scanty hypoderma and starch-ring, a characteristic stereome cylinder, its non-radial fascicles of phloem and weak form of xylem with few tracheides and vessels. The inner sides of the bundles also are strongly wedge-shaped.

Fifth: This, the last division, embraces subgenus ECHINOCaulON. *P. arifolium* as representative, shows a double epidermis, the only one found in this study, a very irregular primary cortex, a strong and characteristic stereome cylinder, a scanty supply of phloem and a remarkably strong and diversified system of woody fibres, together with numerous and conspicuously marked tracheides and vessels. The pith elements in this case are unusually large.

After arranging and grouping the subgenera in a natural sequence based on their anatomy, reference to pages 18 and 19 will show that this classification corresponds exactly to the sequence and grouping there based on their morphology.

Although the eight subgenera group themselves into five divisions as arranged above, there is more or less dissimilarity among some of the tissues of those falling into the same divisions. These variations suggest a number of interesting points.

First: There is a difference in the development of the tissues. I have discussed this with special reference to the classification and will attempt to give reasons for these differences. The general similarity of the tissues of each subgenus has been given above, and this serves to show the distinction between the divisions, but a glance at the plates, especially the cross sections, will show that more or less difference exists between the members of the same division.

Second: Are there any tissues wanting? I have stated that the same tissues are

present in every instance. *Polygonum scandens* and *P. arifolium* have a comparatively weak development of hypoderma and starch-ring, but these tissues are clearly distinguishable. *P. Californicum* is the most puzzling case; I have been unable to distinguish with the material at hand between a stereome cylinder, as characteristic of the other subgenera, and the woody fibres of the xylem, but it would not be safe to conclude that either is wanting; we can regard the woody fibres as having become strongly sclerotic for reasons to be mentioned below.

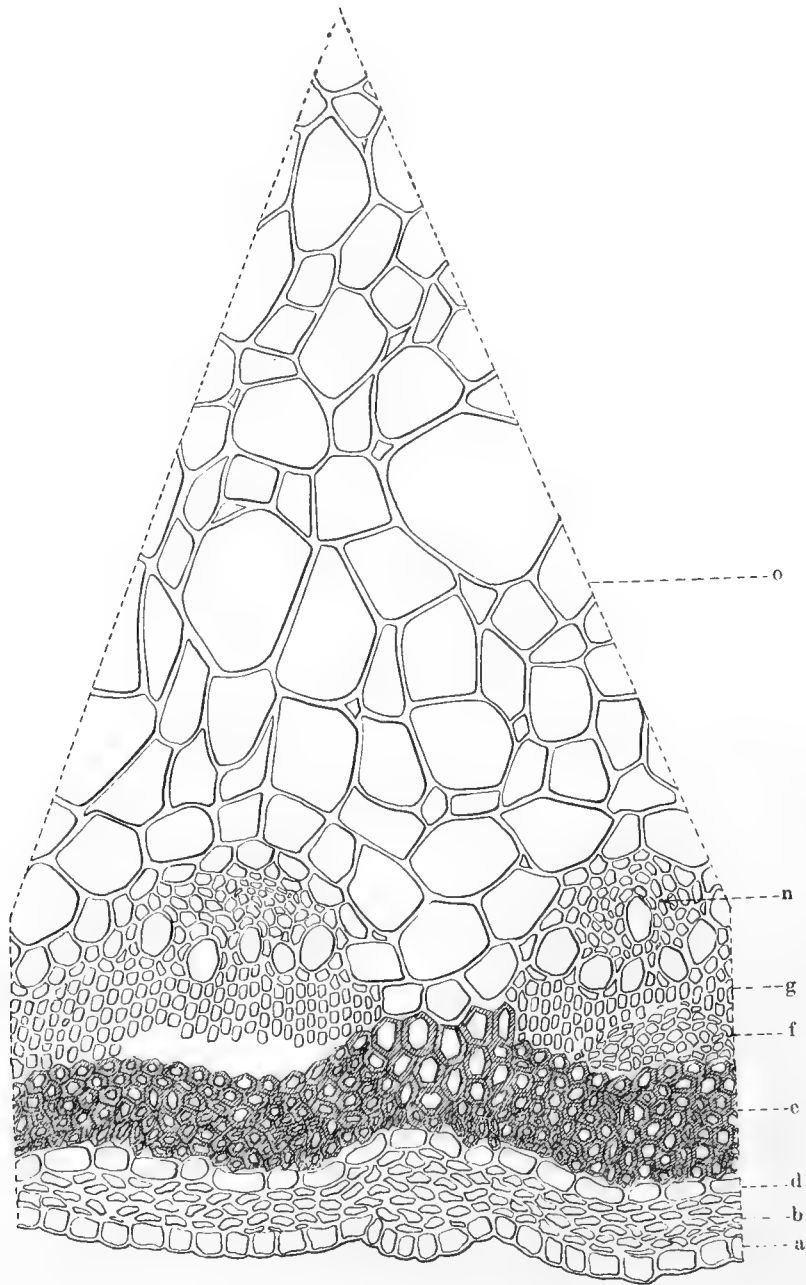
Third: If the stereome is comparatively weak, is it supported by a strong development of xylem or otherwise? In *P. bistortoides* and *P. alpinum* we find a strong cylinder of stereome elements and a comparatively strong development of xylem. *P. Pennsylvanicum* and *P. Virginianum* have a rather weak and more or less interrupted stereome cylinder, but it is supported by a very heavy development of xylem, and in the case of the former species, where the stereome cylinder is broken more than usual, we find fascicles of stereome elements at the inner sides of the collateral bundles.

The two species just considered require rigidity, hence their peculiar structure. On the other hand, such plants as *P. aviculare*, which prefer to grow in localities where they are continually buffeted about in one way or another by nature, need an axis whose characteristic qualities are wiryness and toughness instead of rigidity. This is accomplished by the development of small fascicles of stereids in place of a stereome cylinder. This principle is carried still further, in the example chosen for this study, by the development of fascicles in the hypoderma, thus producing the quality of wiryness and toughness which could not otherwise be obtained.

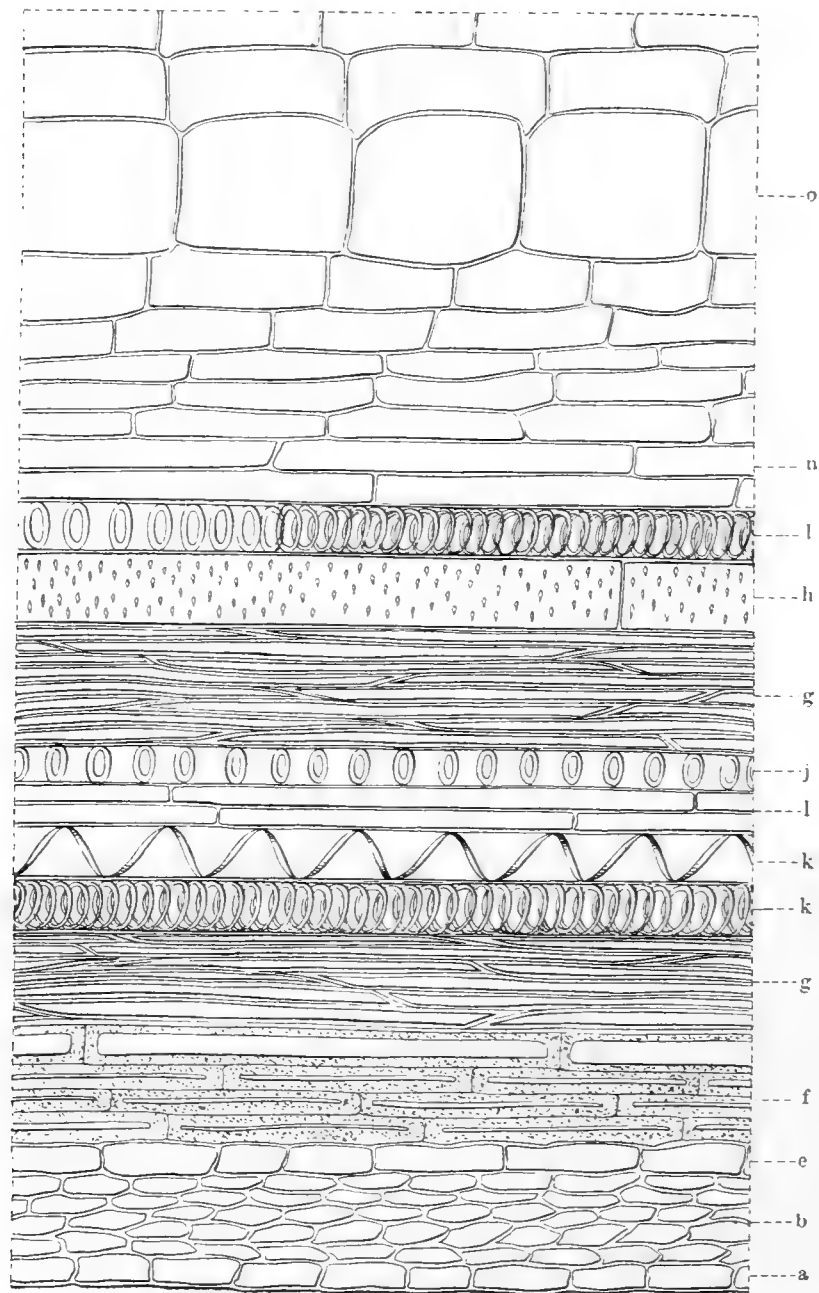
Fourth: In cases where the normal development of stereome is a cylinder, if this cylinder is broken by growth, are the breaks placed economically? In the case of fascicles, are the latter placed to mechanical advantage? The fact that they are is answered, for the first question, in *P. Pennsylvanicum* and *P. Virginicum*. In the latter species we find one class of breaks in the stereome cylinder, namely, those made by the penetration of the starch-ring; these breaks come between the collateral bundles, or what we may term interradially, so that the break is made with the least possible loss of strength. We find two kinds of breaks in the stereome of *P. Pennsylvanicum*, the one as in the case just cited, the other radial or radially with the bundles, thus causing quite a serious loss of rigidity to the axis. However, a strong fascicle of stereids at the inner side of the bundle supports this radial interruption and probably gives at least equal strength. As to the second question: In the cases examined, the stereome fascicles of the cortex were radial with those of the pleromatic cylinder as well as the collateral bundles, thus producing the tough and wiry character of the plants of AVICULARIA.

Fifth: Has environment any influence on the development of different tissues? It undoubtedly has, and appears in two ways. On page 12 I grouped the subgenera according to their habitats and later we saw that the anatomical structure gave the same grouping, which is to say that the same or like environment directs the development of tissues along similar lines. In the second place, we notice that some species such as *P. alpinum*, *P. Pennsylvanicum* and *P. ariculare* have well developed hypoderma and starch-ring, while others, as *P. scandens* and *P. arifolium*, have these tissues but weakly developed. The contrast is so striking that it demands an answer. The first grow in localities exposed to more or less extreme and sudden changes in temperature and humidity. The latter flourish best in swamps or sheltered places, where the changes are less frequent and violent, and where the soil is more generously supplied with moisture. With a plentiful supply of water in the soil, a fairly even temperature and moisture in the atmosphere, the plants need not be protected as thoroughly from transpiration as those growing in more exposed places.

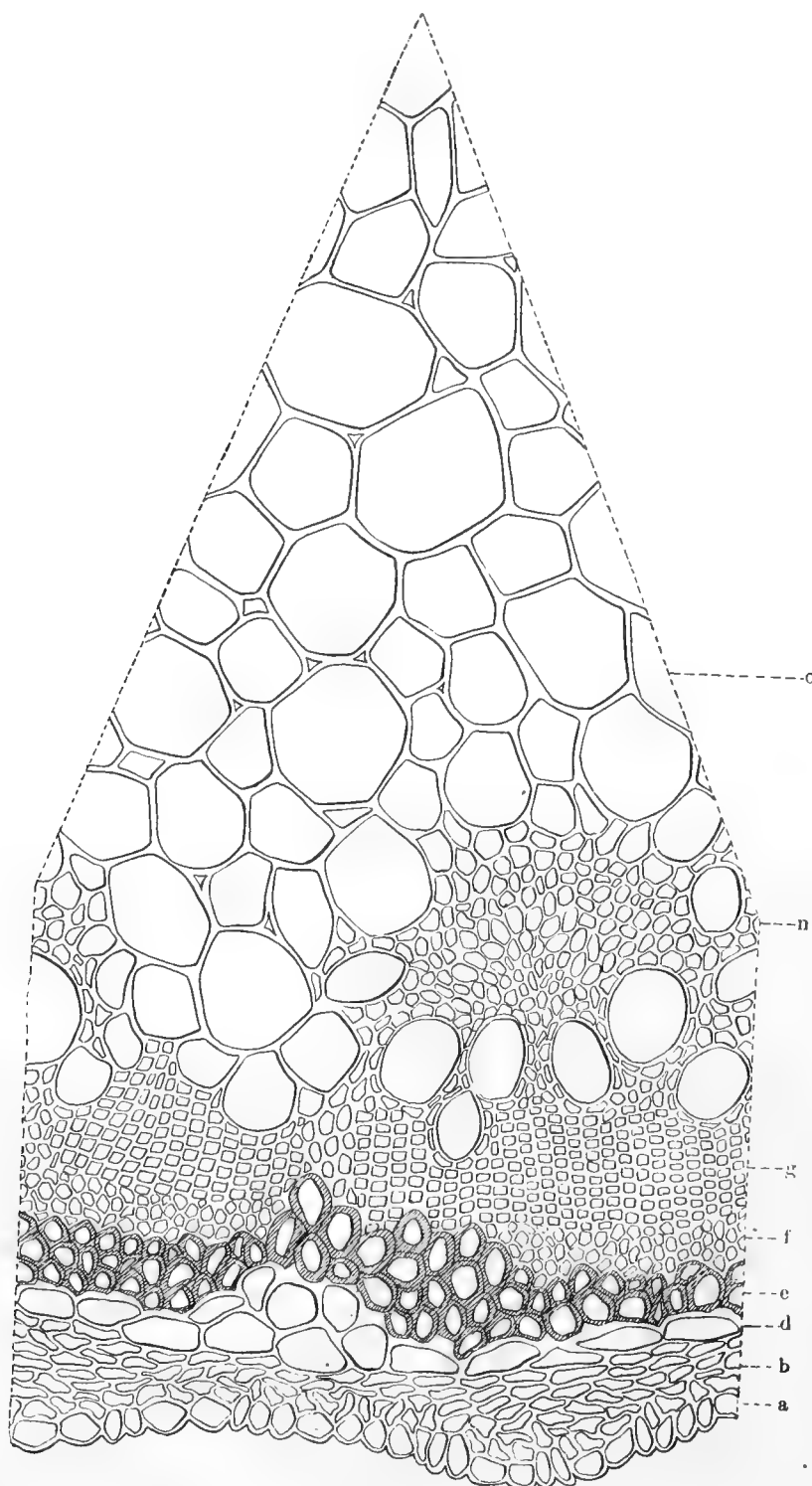




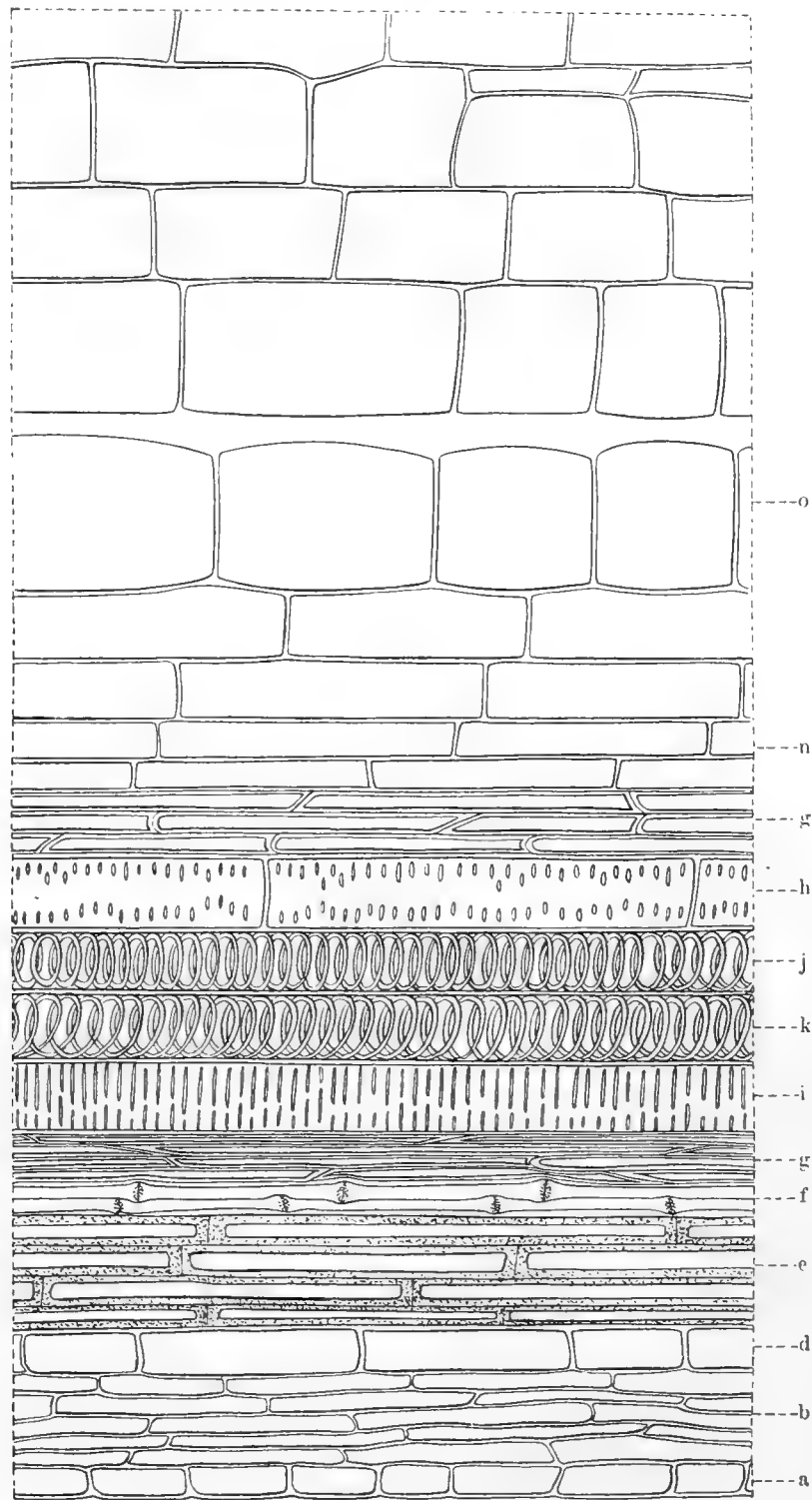
CROSS SECTION STEM OF POLYGONUM BISTORTOIDES PURSH.



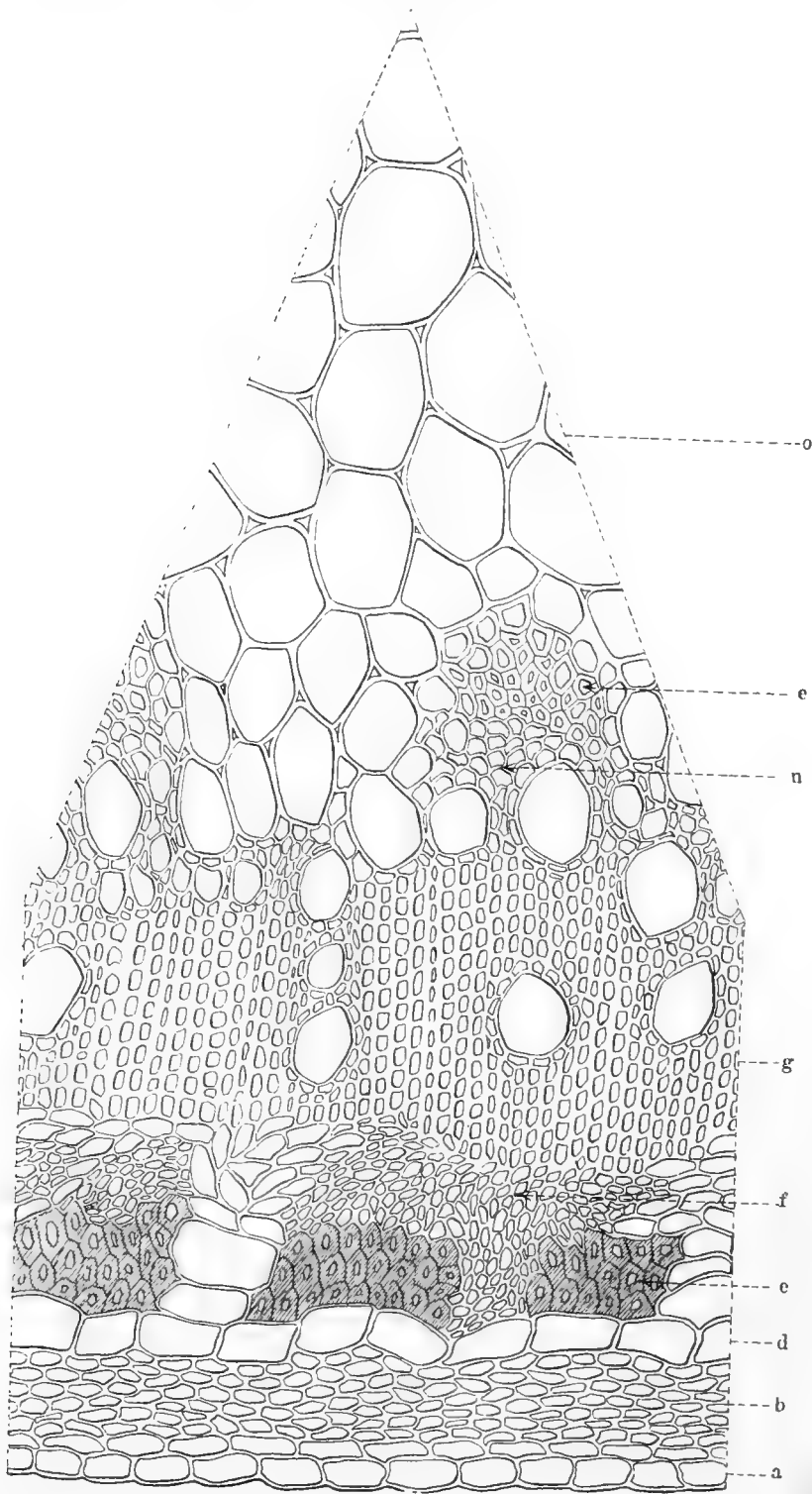
LONG SECTION STEM OF POLYGONUM BISTORTOIDES PURSH.



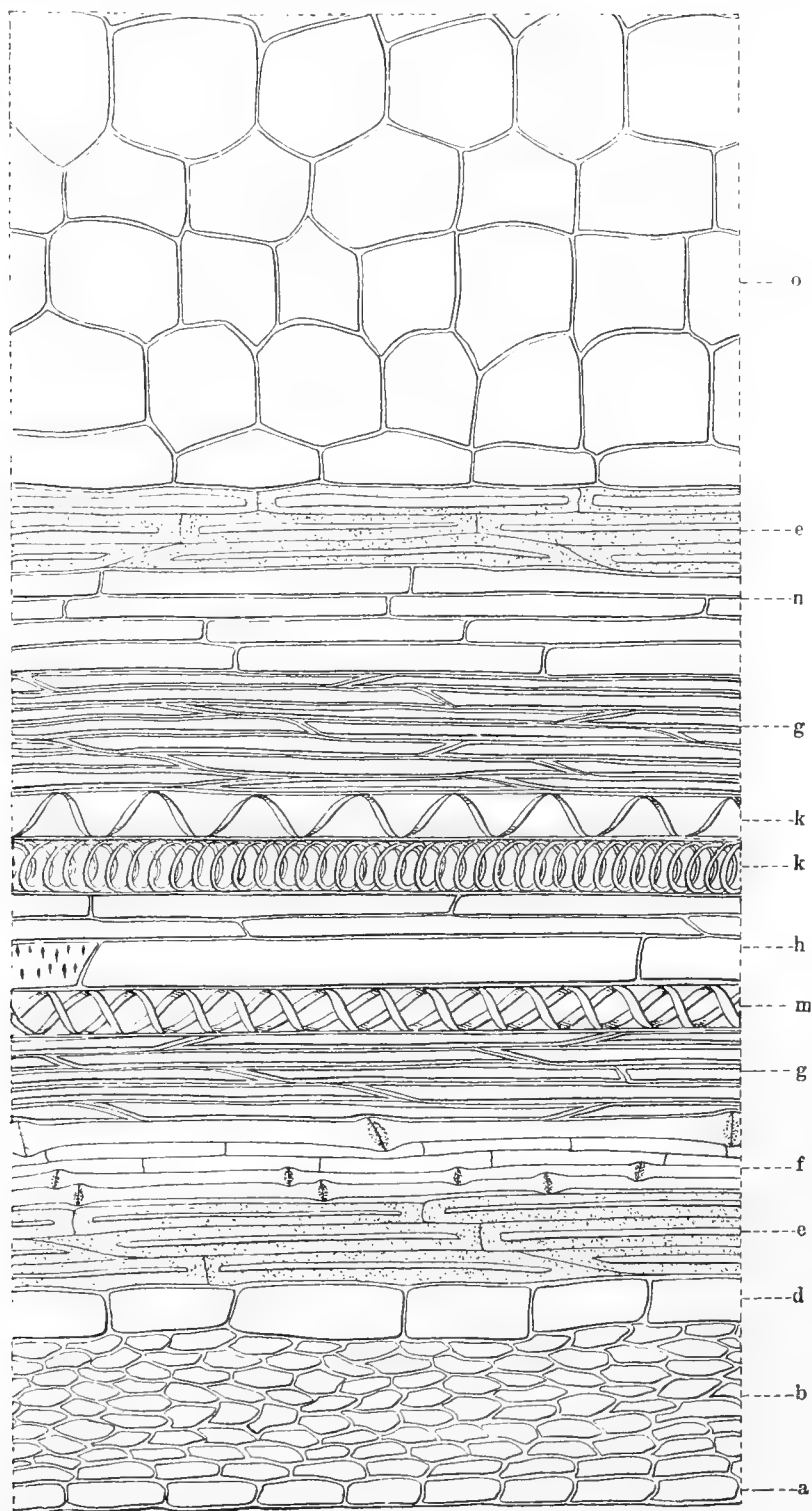
CROSS SECTION STEM OF POLYGONUM ALPINUM ALLIONI.



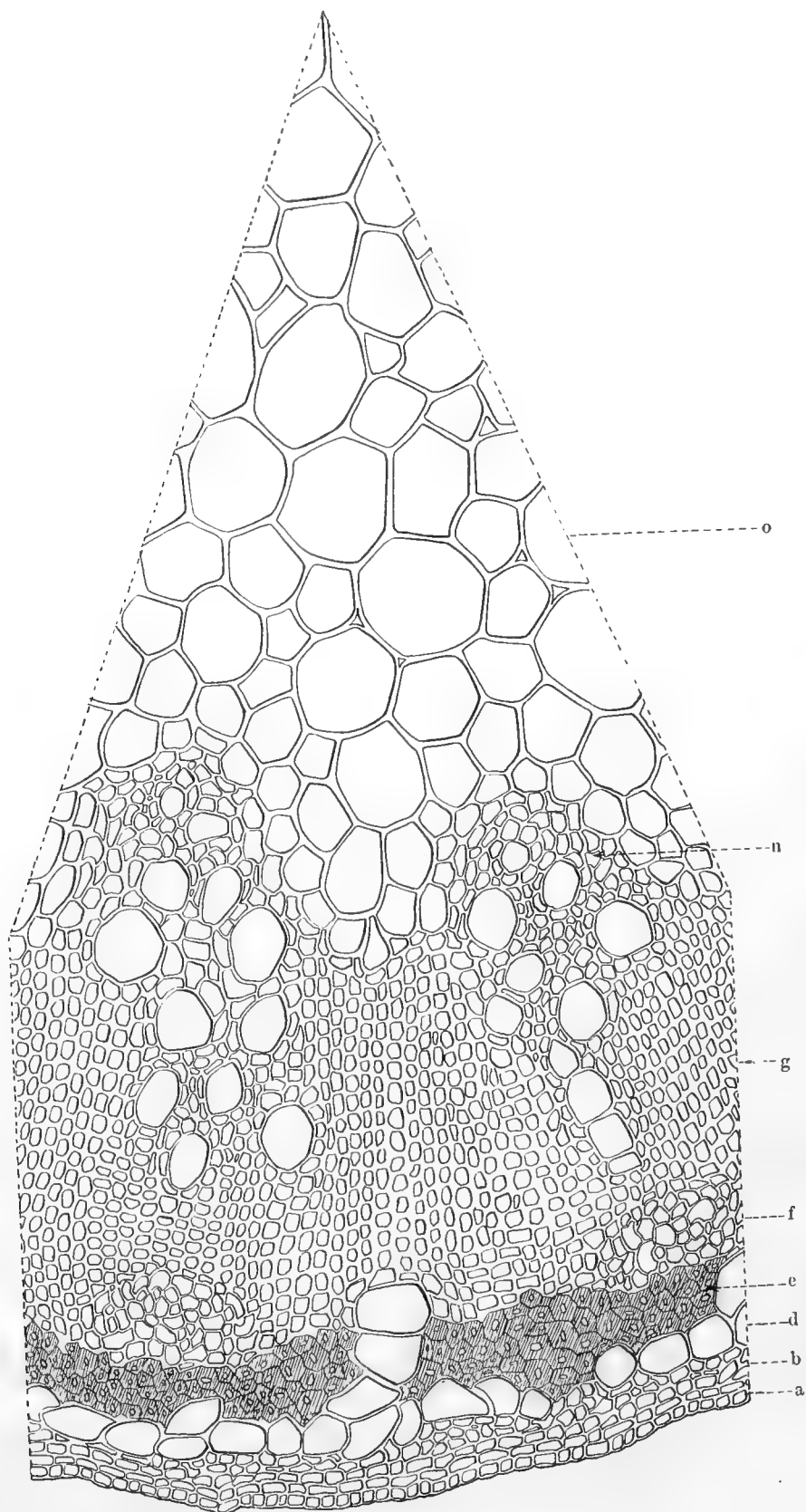
LONG SECTION STEM OF POLYGONUM ALPINUM ALLIONI.



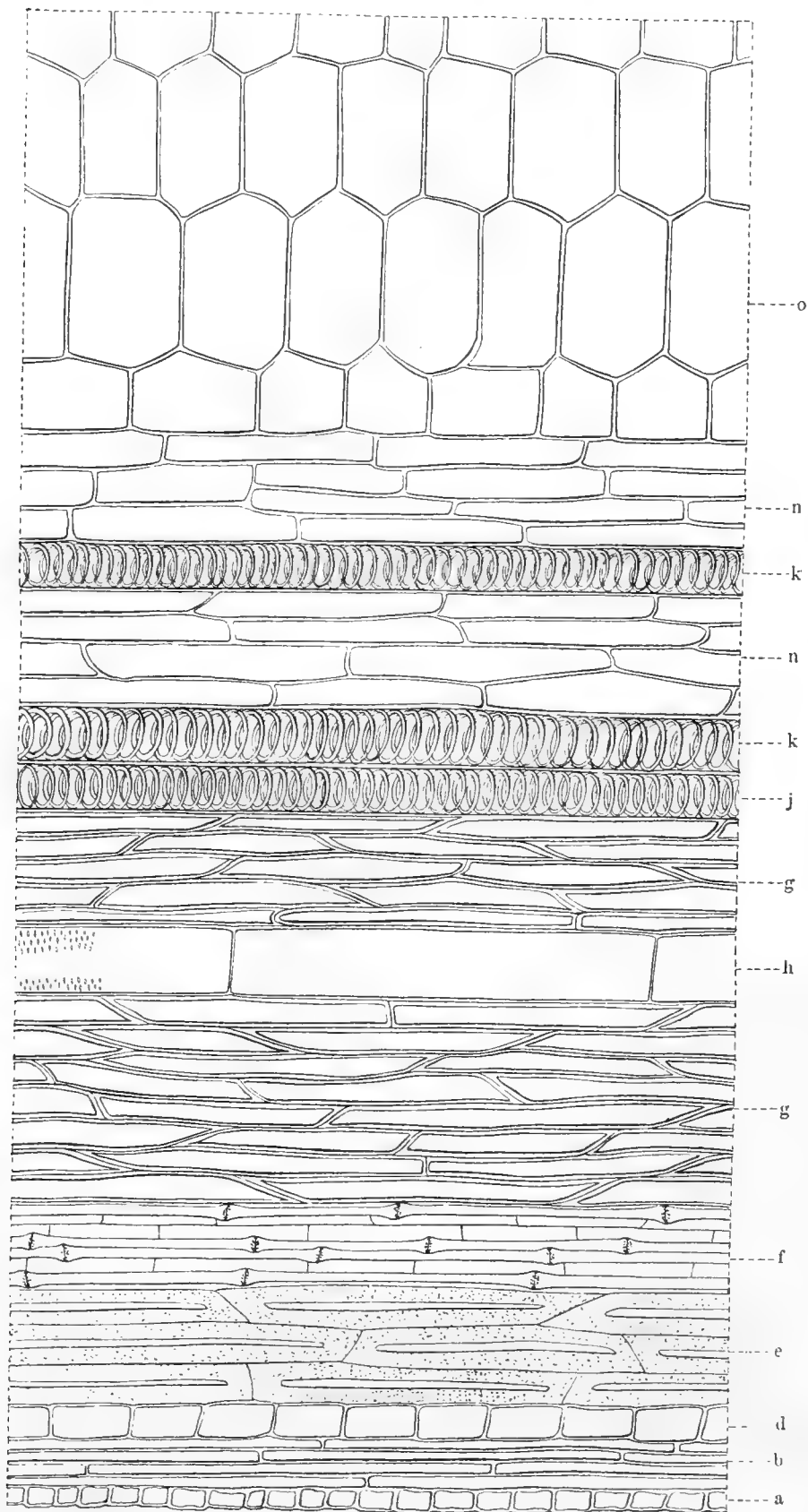
CROSS SECTION STEM OF POLYGONUM PENNSYLVANICUM LINNAEUS



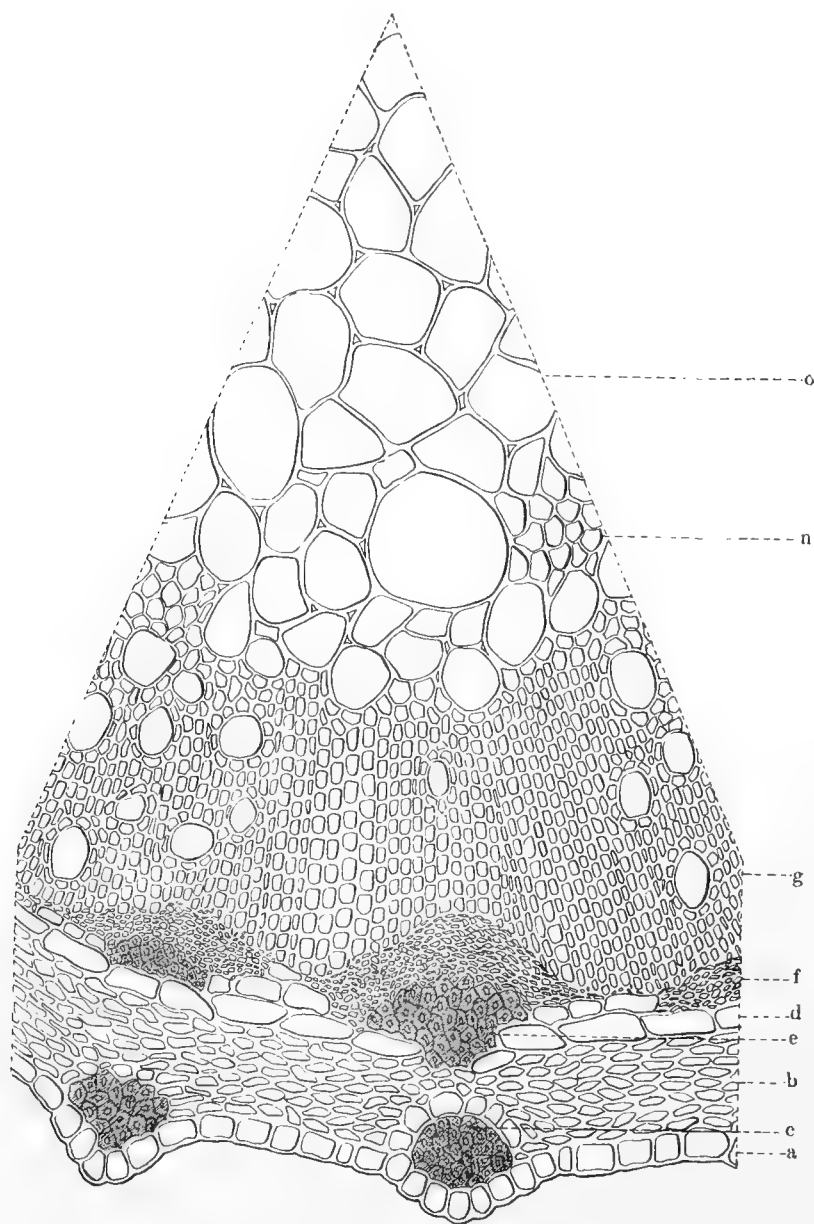
LONG SECTION STEM OF POLYGONUM PENNSYLVANICUM LINNAEUS.



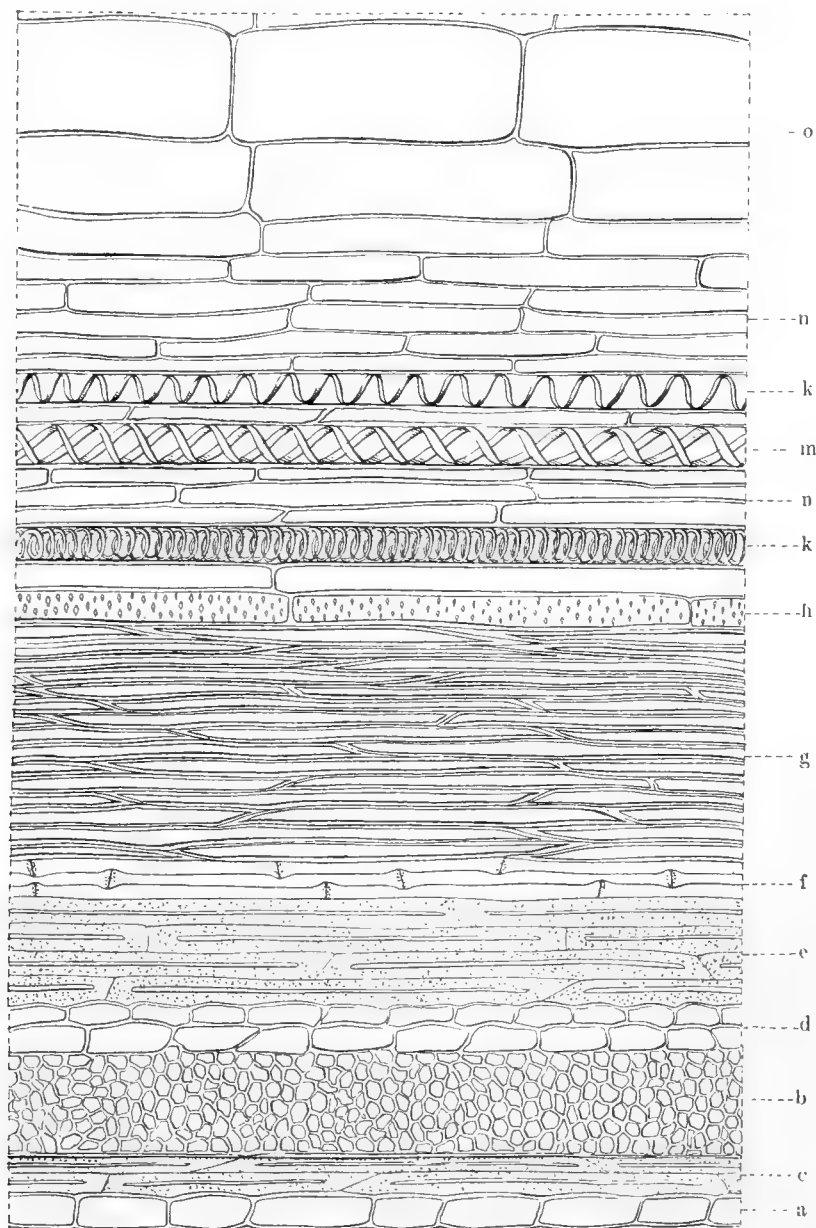
CROSS SECTION STEM OF POLYGONUM VIRGINIANUM LINNAEUS.



LONG SECTION STEM OF POLYGONUM VIRGINIANUM LINNAEUS.

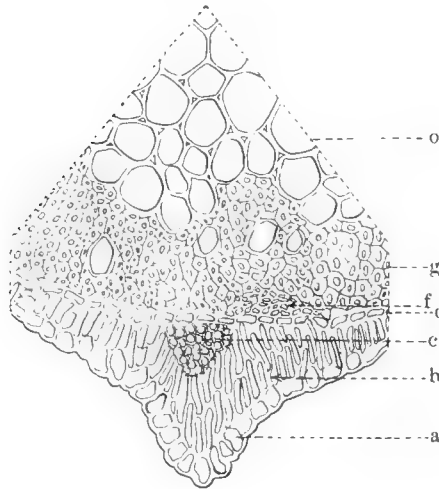


CROSS SECTION STEM OF POLYGONUM AVICULARE LINNAEUS.



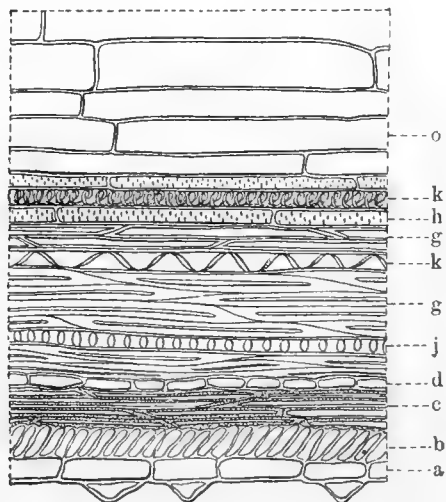
LONG SECTION STEM OF POLYGONUM AVICULARE LINNAEUS.

FIG. 1.

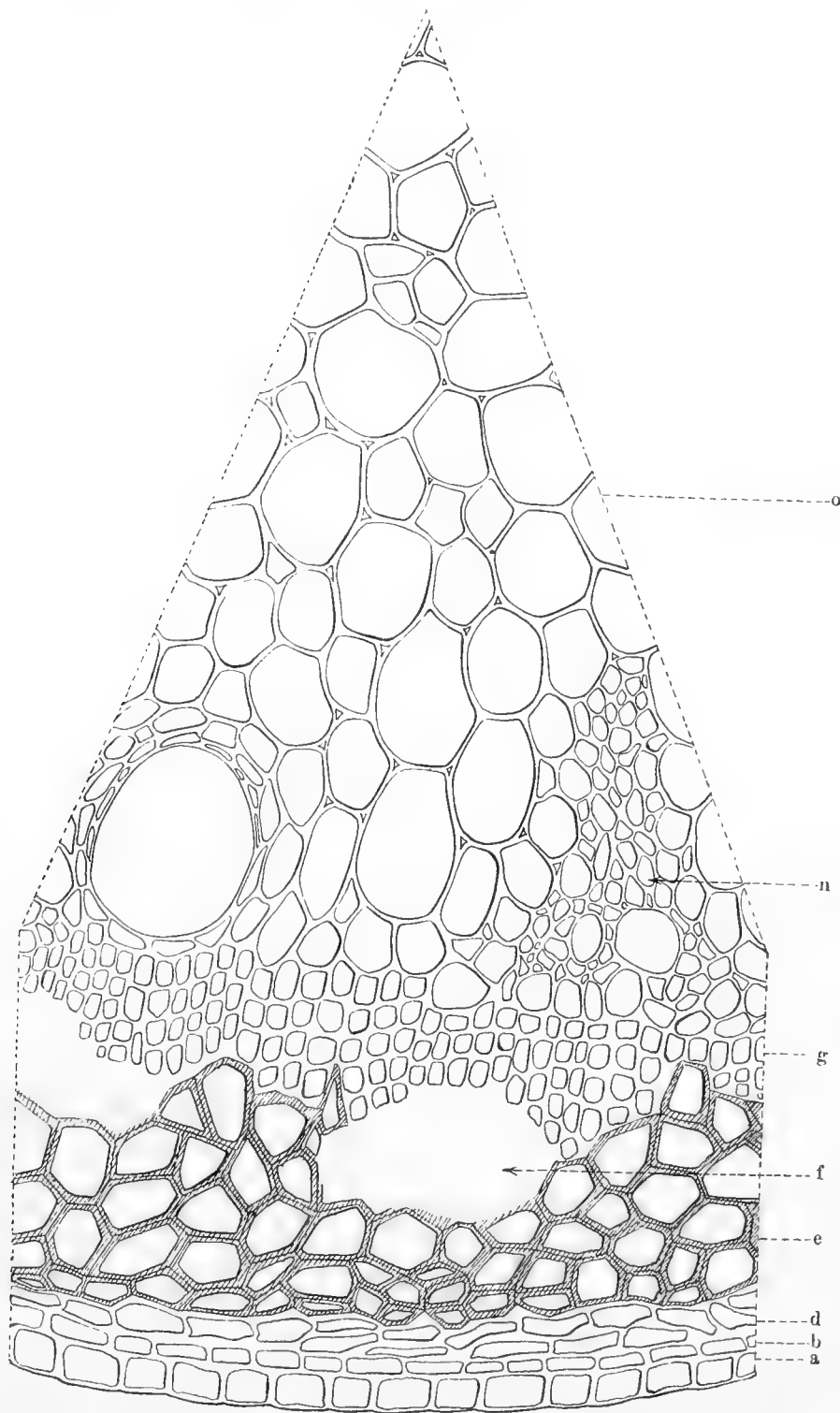


CROSS SECTION STEM OF POLYGONUM CALIFORNICUM MEISNER.

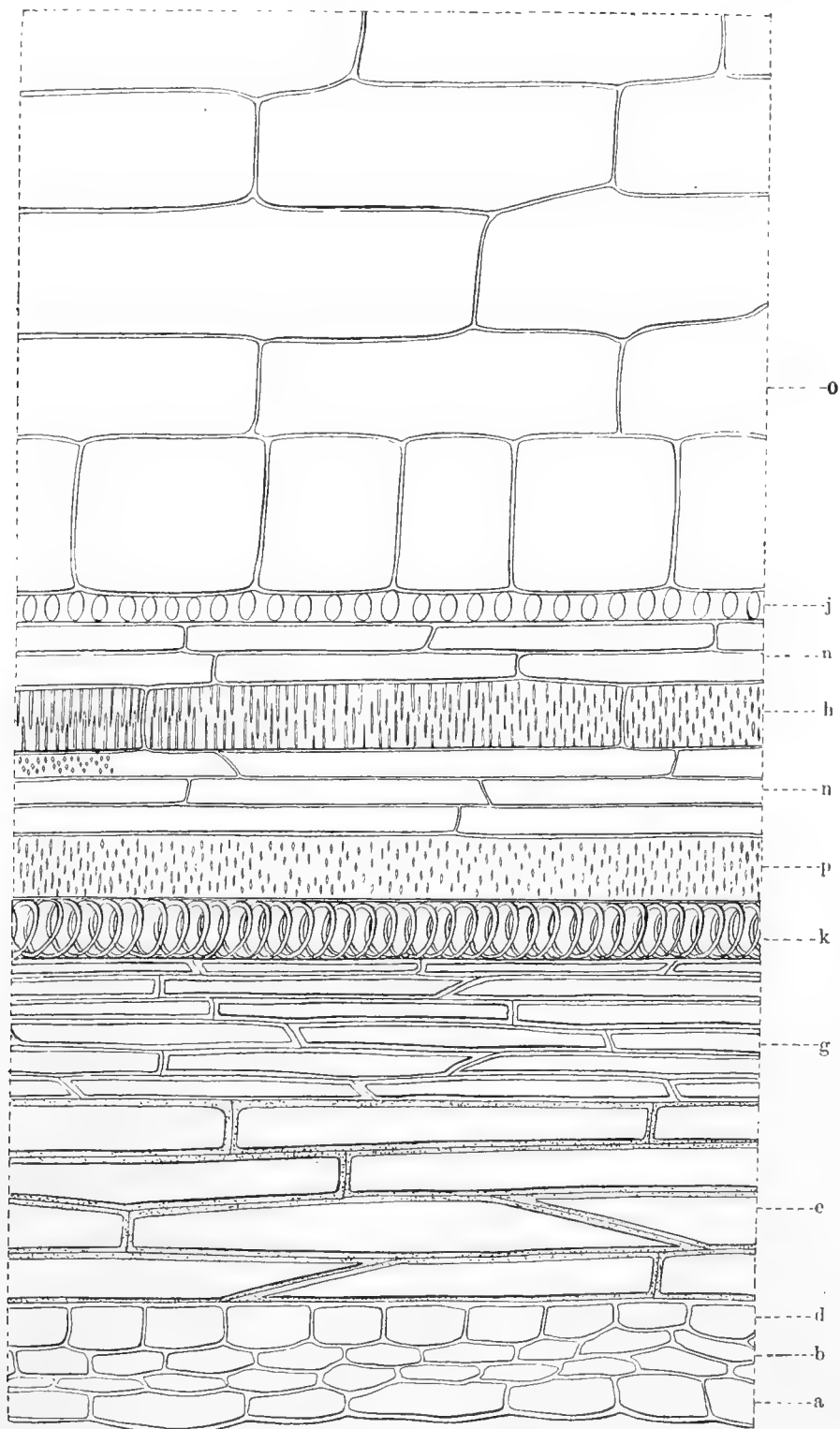
FIG. 2.



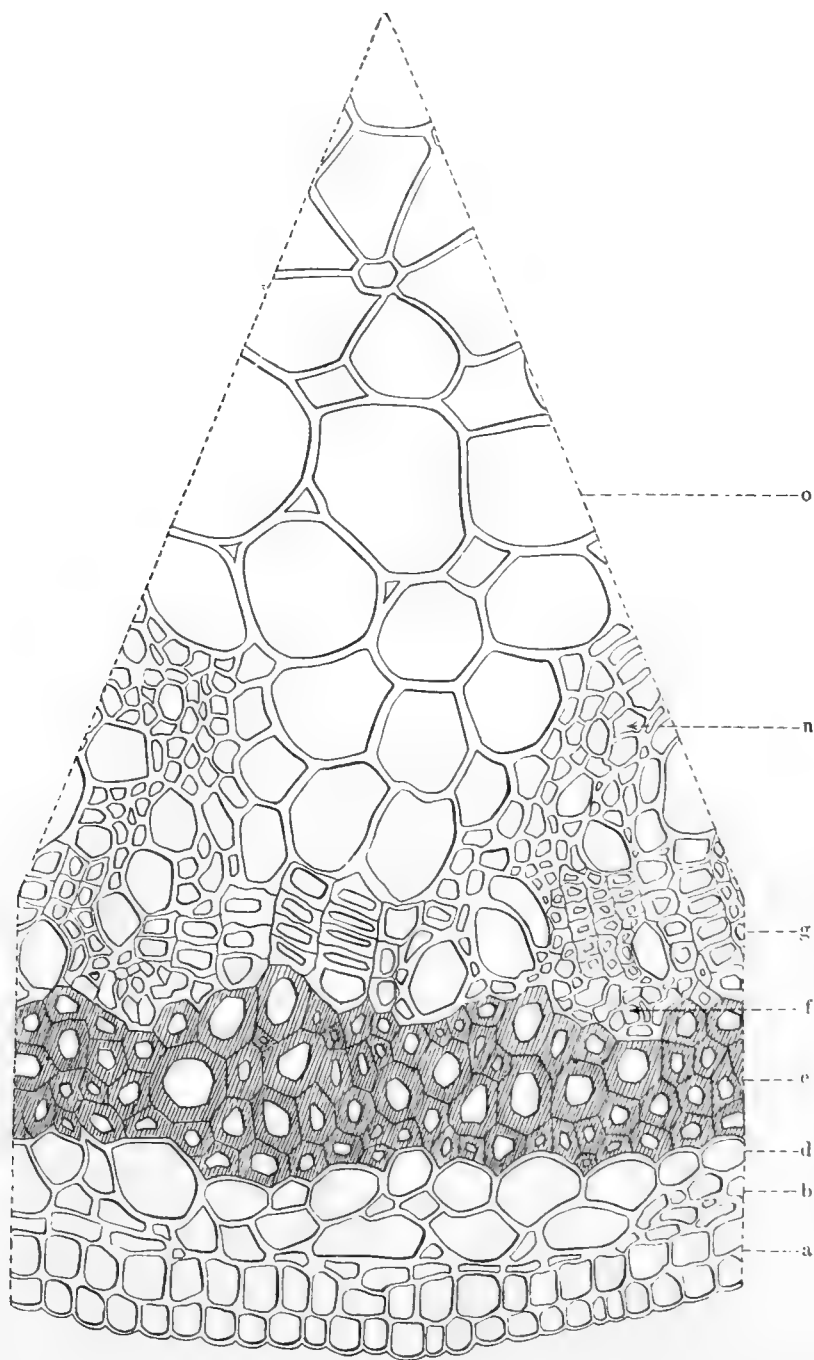
LONG SECTION STEM OF POLYGONUM CALIFORNICUM MEISNER.



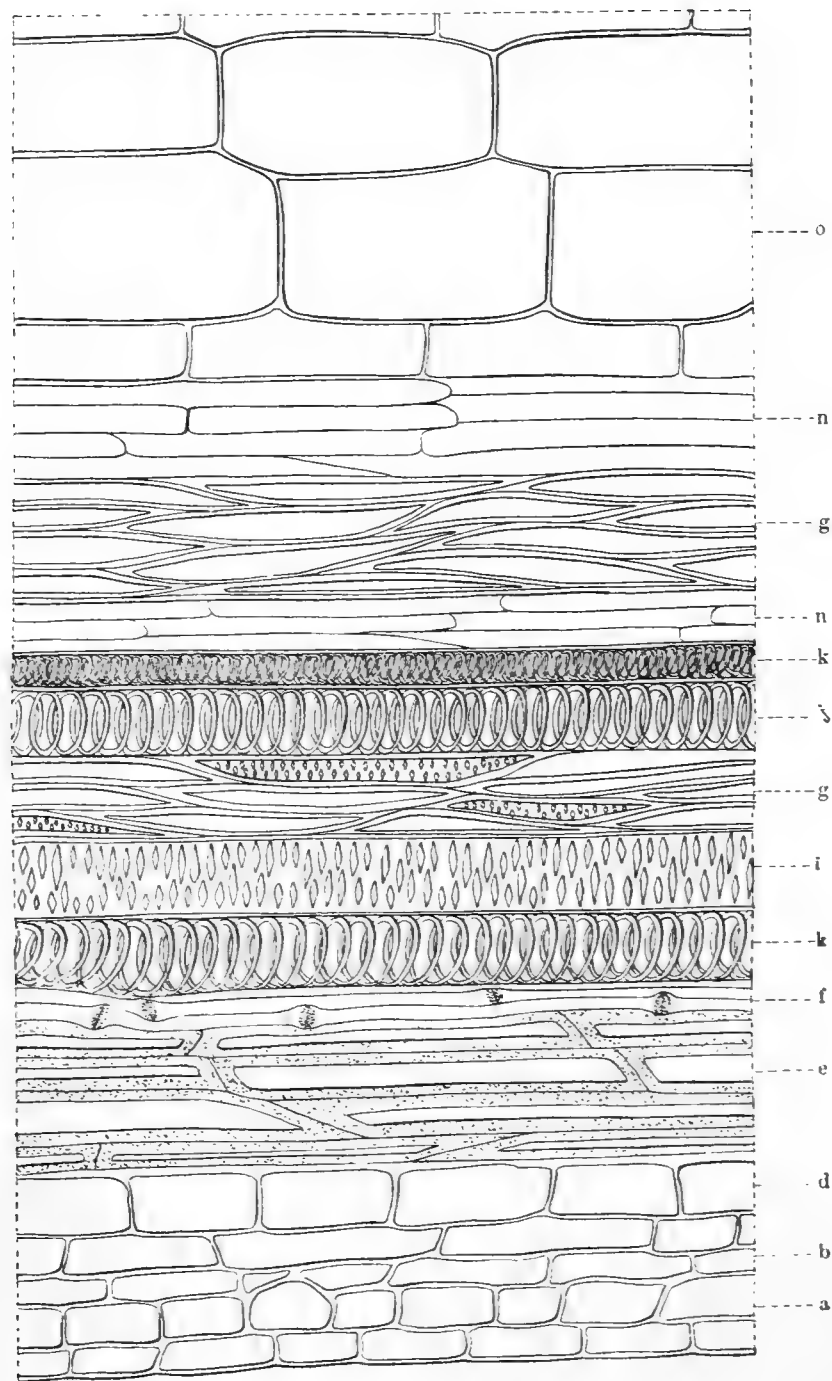
CROSS SECTION STEM OF *Polygonum scandens* LINNAEUS.



LONG SECTION STEM OF POLYGONUM SCANDENS LINNAEUS.



CROSS SECTION STEM OF POLYGONUM ARIFOLIUM LINNAEUS.



LONG SECTION STEM OF POLYGONUM ARIFOLIUM LINNAEUS.

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